Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 64 NEW YORK, SATURDAY, JULY 11, 1914 No. 2

Politics in Chicago Board

Much comment has been aroused by the removal by Mayor Harrison of Chicago of Mr. George Weston as a member of the Board of Supervising Engineers, Chicago Traction, and the appointment to fill the vacancy of Prof. Edward W. Bemis, the well-known and able public utility expert. The reason announced by the Mayor for the removal of Mr. Weston is that he wants to have the city represented on the board by a member more aggressively active in guarding the city's interests. We think that it cannot be successfully maintained that the board has failed to do the work for which it was created by ordinances. The major part of the work allotted to the board was finished long ago. It consisted of supervision of the rehabilitation of the properties. With that great task out of the way, the subsequent duties of the board are less important. The real basis of the objection of the Mayor to Mr. Weston appears to be dissatisfaction because the board has not promoted his personal plan for subway construction. The complaint, then, is not that Mr. Weston was not aggressively active in guarding the city's interests, but that Mr. Weston was not aggressively active in guarding Mayor Harrison's interests. The complaint is not that the board did not comply with the provisions of the ordinances, but that it did not try in every way to carry out his individual ideas for subway development. The appointment of Professor Bemis will give the Mayor a voice in the affairs of the board, but it will not give that control of the board which the Mayor would like in order to make his ideas of subway development effective.

Regulation of Utilities

The discussion on "State Regulation of Public Utilities" in the last number of the *Annals of the American Academy of Political and Social Science* deals with the subject more from the commission than from the company point of view. It reveals the ideas of authors who in the main present the efforts and arguments of the commissions, and it merits careful study. If it had included articles by the regulated in addition to those by the regulating, it would have given a better survey of regulative conditions as a whole. With so many authors and the wide latitude that it was necessary to give them in their treatment of the subject it is not strange that there is some duplication of fact and argument. There is not more, however, than would naturally be expected in such a compilation. The program of regulation has advanced so far that much of what is written on this subject appears to cover first principles. It should be remembered, however, that what is elementary in the states where regulation is now an old story is exceedingly important in states where regulation is just getting well under way. One of the most interesting of the articles, by Mr. Eshleman, of California, is on the question of whether the commissions should have control of the issue of securities. Mr. Eshleman answers this in the affirmative. It would have helped in solving a problem which needs much light if the negative could have been presented by an equally prominent member of a commission who thinks that state control is unwise. No problem in regulation is more far-reaching. We cannot see how the state can control the issue of securities without at the same time assuming a moral if not a legal responsibility therefor. Desirable as this is for investors, the states should be fully aware of the obligations, if any, that they assume.

Bills and Friendship

Officials of electric central stations are congratulated frequently on the fact that it is not necessary in the performance of their duties to have much direct contact with the public. Opportunities for contact with the public can be turned into either intangible assets or liabilities. The great obstacle is that the officials who would try to turn them into assets are not always at hand, and that the representatives who blunder into mistakes which make trouble for the company are likely to be in evidence. Because it is not easy to get men who can meet the public with unfailing courtesy and willingness to please, most officials are glad to have their organizations relieved of frequent direct contact with consumers. It is a satisfaction to these officials to know that as a rule the electrical central station has not much to do with its consumers after service is installed unless there is a question about the monthly bill for energy. Bills are commonly supposed to be a mere matter of form. There is some danger, however, that they may be accepted too readily as a matter of form, and that for that reason an opportunity to create satisfaction and prevent dissatisfaction may be overlooked. A consumer with a complaint about a bill is entitled to explanation and satisfaction. He is entitled to it as a matter of courtesy and business. One complaint by letter, telephone or call is enough. If that is not met properly by the company and a desire to straighten out a difficulty is not made plain to the consumer, the company's policy in this respect is bad policy and will make

trouble later. Though relieved of the necessity of constant direct relations with the public, from which electric railways suffer seriously, central stations cannot afford to lose any opportunities for cultivating public friendship.

The Boston Edison Service Buildings

To many persons the generation and distribution of electricity constitute the alpha and omega of central-station practice, and the auxiliary activities of a modern progressive company of large size are frequently overlooked by those who have never been behind the scenes. Elsewhere in this issue we take pleasure in lifting the curtain from the new general service buildings of the Edison Electric Illuminating Company of Boston, which form the most complete plant ever established by an electric-service company for handling efficiently those features of its work involved in maintenance, stock-keeping, transportation, research, testing, and employees' welfare. Erected at a cost of over a million dollars, designed from basement to roof to meet the demands of the modern efficiency expert, and provided in every department with equipment selected and arranged by men of long experience in the internal administration of the company's affairs, with the able counsel of its engineering staff and valued assistance from without, the result is a revelation.

Space does not permit summarizing here the salient features of the installation otherwise than to point out that specialists in many branches of central-station work will find much to interest them in the descriptions of the various departments housed in the Massachusetts Avenue group, in the illustrations of equipment planned to reduce costs wherever such opportunity appeared, in the extended adoption of labor-saving appliances, protection of stock and machinery against fire, use of the motor drive, routing of supplies, garaging of motor vehicles, and in the provision made for employees' welfare in its broadest sense. Any one of the component buildings of the plant would furnish material for an article in itself and no apology is offered for the amount of space given to the subject, for it is the first time the central-station industry has seen anything so comprehensive planned and built from the ground up without the usual limitations of space and with efficiency as the sole criterion of expenditure. The non-specialist reader will be surprised at the amount of work which such a company is obliged to do outside the immediate fields of station operation and new-business getting, and the executive, we are confident, will see in the co-ordinated installation a striking example of modern scientific management.

For us to single out any one department for special mention seems almost invidious, but surely the perfection of detail evident in the laboratory building and in the equipment of the electric garage will call forth the admiration of the reader, as must also the welfare facilities and the shops of the meter and lamp divisions. Here has been created a great industrial plant and a center of employees' activities, business and social, which will long be of service, and President Edgar and his associates in the Edison Electric Illuminating Company of Boston are to be congratulated upon the successful completion of what may truthfully be called a model for the larger central stations of the country.

Interruptions on Transmission Circuits

A valuable outline of the conditions which affect the continuity of service on a high-voltage transmission line was given in a paper by Mr. P. Ackerman read before the Canadian Electrical Association. Nothing is more curious than the variation in continuity of service between one system and another under apparently similar conditions. The system of the Toronto Power Company seems to be a little unusual in the large number of troubles attributable to lightning, 80 to 90 per cent of the whole as reported by Mr. Ackerman. The territory covered by the system is certainly one in which thunderstorms are frequent, yet other systems having at least as great frequency of danger experience a smaller proportion of troubles due to this particular cause.

Lightning is an enemy of most unexpected directions of attack. Sometimes one of two lines apparently similar in all essential respects will be in continual trouble from lightning and the other reasonably free from it. No one has yet succeeded in determining why lightning strikes just where it does, although in a general way certain localities have acquired sinister reputations associated with apparent inducing qualities like the presence of high ridges over which the transmission line passes, or valleys which seem to be a favorite haunt of storms. At all events it is well understood that remedial measures can be applied even where conditions are very bad. Station apparatus can now be effectively safeguarded by the use of well-known types of lightning arresters, so that actual damage to apparatus is relatively rare. In many instances the line itself can be effectively protected by the usual arrangement of grounded guard wires, yet for some reason apparently inexplicable this precaution frequently fails of its purpose.

The sources of trouble to which Mr. Ackerman refers are chiefly those which do not involve the destruction of apparatus, but rather those which come from damage at the insulators either through puncture followed by an almost explosive rush of current or by "flashing over," with the subsequent arc which may destroy the insulators and burn off the line. On a modern steel-tower system one depends entirely on the insulators for security and when these fail the line is likely to be put out of service in the course of a very few seconds. On wooden-pole systems the lightning will frequently splinter more or less severely a succession of poles, jumping off perhaps at every insulator, yet without permanent damage sufficient to cripple the line. With steel poles and pins attention must be concentrated directly on the insulator itself. Mr. Ackerman's experi-

ence is very instructive in this matter. The insulators concerned are well-designed ones of porcelain, of the pin type. It is found that so far as interruption of service is concerned the danger of puncture is much greater than that of flashing over. A puncture is often followed instantaneously by a rush of current to the pin that not only completes the destruction of the insulator but burns off the line before the overload relays have a chance to act. The flash-over may also cause the wrecking of the insulator and the loss of the circuit. As, however, this result is less frequent than in the former case, Mr. Ackerman's attention was very largely directed to the proper testing of insulators against puncture. In Mr. Ackerman's opinion the puncture test voltage should be twice that required to produce a flash-over, and the latter, of course, should have ample leeway over any operating voltage likely to be found on the line.

Experimental investigation of the relation between puncture and flash-over voltage showed that it is easy to obtain by a suitable test puncture-resisting strength sufficient at least to insure the probability of a flash-over without puncture, and the next step was to investigate the remedial measures to prevent arcing in a flash-over powerful enough to injure the line.

Some interesting experiments were made with a modification of the horn device applied at the insulators to keep the flash-over from being localized. Better than this, however, proved to be an arc-extinguishing device installed at the station, consisting of an overload relay acting to cut across the line instantaneously through a high-tension fuse. This incipient short-circuit acts to draw away current from the damaged insulator, stopping the arc there and blowing the fuse so quickly that the effect on the line is only a momentary flicker on the voltage, after which service goes on as usual. This scheme is reported to work excellently for flash-overs, and Mr. Ackerman remarks that the first requisite for its success is an insulator that will not be punctured, especially—we may add—because this particular treatment is likely to start a minor surge which may impose unusual strains. Nevertheless, if so simple a scheme can check any considerable proportion of line interruptions it is worth a trial.

Mr. Ackerman notes one curious and interesting fact which ought to be investigated further regarding the weaknesses which become evident after the lapse of considerable time even in insulators which have withstood every reasonable test. Just why a porcelain insulator should occasionally give way after a year or two, in the absence of any unusual strain or mechanical injury, is not easy to understand. It is possible, of course, that there may be a certain amount of weathering at the surface, aided perhaps by slight electrolytic action at the supports, or the effect may even be a purely mechanical one due to a perpetual minute grinding by reason of the working of the conductors over their support. Whatever the cause, the effects are unpleasant, and it will be important to note whether they occur to the same extent in the case of suspension insulators as with the ordinary pin type here considered.

Electrification Problems

In a brief paper read before the Canadian Electrical Association Mr. J. A. Shaw entered a conservative plea for high-voltage direct-current traction. As in many similar discussions, the outcome hinges on the assumption made for the installation. In comparing single-phase and direct-current traction the author has proceeded on the assumption that in the former case energy for the system would be taken from the lines of some existing supply company and at a frequency which would compel the use of converting stations, the first cost and operative expense of which, together with the loss of efficiency entailed, would put them about on a parity with those necessary with the direct-current system. In some instances the assumption may be justified, but we are rather inclined to the opinion that with a really large electrification project it would be found desirable either to have absolute control of the transmission system or to secure energy by placing suitable generators at existing hydroelectric plants. The result of the author's hypothesis is, of course, to turn the scale toward direct current, in this case bringing to substantial equality in cost of energy and in cost of equipment the 2400-volt direct-current and the 11,000-volt single-phase system.

Perhaps the most uncertain point of all in the comparison, whether made as from Mr. Shaw's hypothesis or otherwise, is the matter of maintenance on the two types of locomotive. As regards the efficiency of the equipments, Mr. Shaw is probably right in judging that there is no material difference, but it is certainly not pertinent to quote the maintenance costs of the direct-current and alternating-current locomotives in use around New York as typical, since the so-called single-phase machines had to be equipped for working on both systems with a complete double set of collecting and control devices, and with the added difference that the alternating-current machines were deliberately made, for convenience, of a somewhat smaller output than the direct-current locomotives. When figures are obtainable from some of the large foreign alternating-current systems using heavy locomotives it will be possible to make a comparison on much more certain data. Considering the fact that the alternating-current system has been tentatively chosen for the Swiss railways, largely on the ground of operative superiority, it would seem only fair to assume that there is little to be feared in this particular matter. While following rationally from the data chosen and well worth careful reading by all engineers interested in the subject, Mr. Shaw's discussion of the whole matter does not seem to throw any new light on a situation which is certainly at present sufficiently befogged. The direct-current work now under way at 2400 volts will answer many questions as to the relative economy of the two rival methods of traction. Every friend of electrification will heartily wish success for the new undertaking.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Majority and Minority Reports on Public Ownership in District of Columbia

The committee on the District of Columbia of the House of Representatives has made a favorable report on the Crosser bill, which provides for public ownership of the electric railways in the District of Columbia. The minority members of the committee have obtained from Congress thirty days in which to submit a minority report. It is expected that this report will be presented about the end of July or the first part of August.

Mr. Theodore W. Noyes, editor-in-chief of the *Washington Star*, published in the issue of that paper for July 3 a long article against the Crosser bill. He declared that the District should approve the procedure of admonishing and threatening the public service corporations into more hearty co-operation with the Public Utilities Commission, but that the legislative advance of the bill should be abruptly halted at this point. He declared that public ownership under the Crosser bill is premature, unnecessary and unwise.

Insurance for Employees in Pittsburgh

The Duquesne Light Company, of Pittsburgh, has taken out an insurance policy for all employees who have been in its service for one year or longer. The insurance was taken out with the Equitable Life Assurance Society under the group-plan arrangement. Employees who have been in the service for two years or more will be insured for an amount equal to one year's salary, payable in the event of death in twelve equal monthly payments to any beneficiary designated by the employee insured. Employees in the service one year and less than two years will be insured for an amount equal to one-half of one year's salary, payable similarly. No policy will be issued in excess of $2,400. In the light company, railways company and other Pittsburgh properties controlled by the Philadelphia Company more than 14,000 persons have received insurance in this way.

Iron and Steel Electrical Engineers

The following papers will be presented at the eighth annual convention of the Association of Iron and Steel Electrical Engineers, to be held at the Hotel Statler, Cleveland, Ohio, Sept. 14 to 19:

"Some Electrical Problems Practically Considered," by Mr. B. G. Lamme; "Statistical Data of Electrical Application in the Iron and Steel Industry," by Mr. R. Tschentscher; "Applications of Auxiliary Apparatus in Iron and Steel Mills," by Mr. Stewart C. Coey; "Load and Use Factors as Applied to Motor Installations," by Mr. H. M. Gassman; "A Synchronous Condenser Installation for Power-Factor Correction and Voltage Regulation," by Mr. W. O. Oschmann; "The Apprenticeship System as Applied to Steel Mills," by Mr. B. W. Gilson; "Cables and Accessories," by Mr. J. C. Bowman; "Underground Transmission in a Steel Plant," by Mr. F. D. Egan; "Hot Metal Cranes for Steel Mill Service," by Mr. R. J. Mullally; "The Control of Induction Motors for Rolling-Mill Drive," by Messrs. Wilfred Sykes and G. E. Stoltz; "Magnetic Control Characteristics," by Mr. H. F. Stratton; "Alternating-Current and Direct-Current Magnetic Controllers for Auxiliary Motors," by Mr. W. O. Lum; "Switchboard and Switching for Steel Mills," by Mr. Saul Lavine; "Machine Tool Drives," by Mr. Charles Fair; "Condensers and Their Auxiliaries," by Mr. P. N. Ehrhart; "Silent Chain Power Transmission," by Mr. F. L. Morse; Organized Safety," by Mr. L. R. Palmer; "High Candle-Power Incandescent Lamps for Steel Mill Illumination," by Messrs. G. H. Stickney and A. B. O'Day; "Transformer Construction for Steel Mills," by Mr. G. A. Waters; "Watt-Hour and Ampere-Hour Meters and Their Application in Steel Mills," by Mr. R. C. Lanphier; "The Flaming-Arc Lamp in the Iron and Steel Industry," by Mr. Allen T. Baldwin. Mr. W. T. Snyder, McKeesport, Pa., is secretary of the association.

Electric Power Club Approves Single Rating

At the recent meeting of the Electric Power Club at Hot Springs, Va., attended by representatives of most of the manufacturers of electrical machinery in this country, both large and small, Mr. Charles Robbins, East Pittsburgh, Pa., read a paper on the subject of single rating of electric motors. All special-application motors used for crane, elevator, machine-tool and railway work are now so rated, but the bulk of general-purpose motors are still sold with a time-overload rating in addition to the nominal rating, and it was recognized that any immediate change in practice would cause considerable confusion in the trade. The members of the Electric Power Club unanimously adopted a resolution expressing entire concurrence in the principle of single rating and instructing the different committees to work constructively toward the single-rating method in all standardization work. The club's committee will co-operate with those of the A. I. E. E.

Prof. F. B. Crocker, Ampere, N. J., president of the club, also presented a paper defining the proper limits of standardization work. The club officially adopted 550 volts as a standard pressure for direct-current motors, in addition to 115 volts and 230 volts. For direct-current generators 600 volts was accepted as standard, in addition to 125 volts and 250 volts. For alternators the standards adopted were 240 volts, 480 volts, 600 volts and 2400 volts.

Utah Company and Government Land

Judge Marshall of the United States District Court at Salt Lake City, Utah, has rendered a decision against the Utah Light & Railway Company in a suit brought against it by the government. The company was enjoined from occupying government land with portions of its hydroelectric power works, pipe line, diverting dam and power house in Big Cottonwood Canyon.

Westinghouse Strike Situation

The Westinghouse Electric & Manufacturing Company and other companies in the East Pittsburgh district which have been affected by the strike have advertised in large cities of the country for men to take the vacant places in the plants.

Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, when in New York on July 7, said that the situation looked more favorable than at any other time since the men went out. He said that men were returning to work each day and that several hundred returned on July 6.

Condition of Water-Power Legislation

It is understood in Washington that several more White House conferences may be necessary before the executive and legislative branches succeed in untangling what they call the difficult situation relating to proposed legislation concerning water-powers in navigable streams and on public lands.

Advocates of such legislation at this session of Congress who do not approve of specific plans offered in the bills now before the House, or who approve of one bill and not another, are hoping to find that the difficulties will make it impossible to pass any legislation at this session, and tactics connected with delay have been brought into play. In view, however, of the active interest of President Wilson, the Secretary of War and the Secretary of the Interior in the subject, and the announced intention of administrative leaders to force legislation at this session of Congress, there is little doubt that an agreement on the proposed legislation will be reached and that it will probably be one suggested personally by President Wilson.

There is a rumor in Washington of a disagreement on the subject of water-power legislation between the Secretary of War and the Secretary of the Interior. The possibility of such a disagreement lies in the fact that if both bills now before Congress are passed the Interior Department will lose to the War Department a certain amount of authority.

The Adamson bill for developing navigation and the water-power resources of navigable streams was to have come up before the House on July 2. It did not come up, thus halting the Ferris public domain dam bill, which was to have followed it in the House. Instead, it was announced that it would be necessary to have further conferences at the White House concerning both measures. These conferences are continuing, and the subject is taken up constantly at Cabinet meetings.

Secretary Garrison and Secretary Lane originally agreed upon six proposed amendments to the two bills and submitted them to the House leaders. They proved unsatisfactory to the House leaders, who are now dividing themselves into "conservatives" and "radicals." The Ferris bill, reported by the committee on public lands, was prepared under Secretary Lane's direction and represents the ideas of the "conservationists." The Adamson bill, reported by the committee on interstate commerce, was the result of hearings at which many water-power authorities were heard. The War Department is behind the Adamson measure.

If the Adamson bill passes, it will take authority away from the Forestry Service and the Interior Department and give it to the War Department. It will give to the power companies the future increase of values resulting from growth in population and industry. The Adamson bill does not limit or control capitalization of power companies.

In the House a determined fight is being organized against the Adamson bill. Representative Murdock has announced that he intends to lead such an opposition, assisted by Representatives Henry T. Rainey, Martin D. Foster and Graham.

A number of amendments to the Adamson bill have been framed, ready for presentation as soon as it comes up. On the other hand, water-power authorities who believe the bill is what it should be are flooding Congress with telegrams advocating its passage, and the statement is made in Washington that these telegrams are doing the bill more harm than good inasmuch as many of them are identical in language and seem to show a common source of inspiration.

Revision of Patent Laws

The House of Representatives on July 6 passed two measures dealing with patent affairs. One is an act to amend the Revised Statutes so that it shall no longer be necessary to have patent applications attested by two witnesses, and the other is an act providing that the Commissioner of Patents of the United States shall exchange with the Dominion of Canada Patent Office copies of patents now in the United States Patent Office and hereafter issued.

During the debate and passage of the acts the curious fact was developed that the principal reason why the House committee on patents recommended in its report the adoption of the resolution providing for the exchange with Canada was that such an exchange system would result in there being filed in Canada copies of United States patents away from danger of fire in the present Patent Office in Washington.

The report brought out the fact that the danger of destruction of the Patent Office by fire in Washington is imminent. The copies of patents already printed and on hand in Washington are stated to have cost the government about $50,000. Representative Mann caused the Democratic majority in the House some discomfort by bringing out the fact that the government is giving away $50,000 worth of property rather than build a new Patent Office in Washington that would be fireproof.

It was developed that the system of exchange with Canada was in effect ten or twelve years ago, but was discontinued. Representative Oldfield called attention to the fact that there is already in existence an exchange system of patents with other countries which aids the research work of the Patent Office.

Vacuum Cleaners Used to Dust Pullman Cars

Four motor-driven vacuum cleaners, and the electric-service outlets from which to operate them, have been installed at Memphis, Tenn., by the Pullman company for cleaning cars delivered to that terminal. Mr. W. H. Bucher, local manager of the Pullman company, announces that tests are being made on the new equipment which if satisfactory will lead to the adoption of vacuum cleaning at all terminal stations. The railroad yards at Louisville are also being wired for vacuum-cleaner service.

Each cleaner is operated by a 1-hp direct-connected motor. By using one of these devices two negroes can clean a car in two hours, thus making it possible to renovate thirty cars a day with the equipment installed. The cleaners are first used as blowers for removing the dust and dirt from the ceilings of the cars. Then the air current is reversed, and the seats and carpets are cleaned by the vacuum principle.

Results of First Five-Year Period of Commonwealth Edison Employees' Savings Fund

On July 1, 1914, the first five-year period of the Employees' Savings Fund of the Commonwealth Edison Company of Chicago came to an end. The results of this unique undertaking have been very profitable to the employees who subscribed to the fund, and they all seem pleased. The company benefits by this feeling of satisfaction and also by adding materially to its number of small stockholders.

The plan was that an employee might deposit either 3 per cent or 5 per cent of his monthly wages with the treasurer of the fund, as in a savings bank, receiving interest at the rate of 6 per cent compounded semi-annually, provided he kept his money in for five years. The employee received a pass-book in which his deposits were entered. Membership in the fund was in no wise compulsory, every employee receiving his full salary monthly and voluntarily tendering the percentage which he elected to deposit in the fund. In almost all cases this was 5 per cent. It was provided that at the end of the five-year period the depositor might receive his money back with the 6 per cent compound interest in cash, or, if he preferred, might receive stock in the company at par (from a fund of treasury stock set aside for the purpose), so far as the total of his deposits and interest would buy even hundred-dollar shares of the company's stock. It is of interest to see how the plan has worked out in actual practice.

An Example of the Plan of Operation

For illustration, the case may be taken of a man earning $60 a month who deposited $3 a month for the five-year period, or $180 in all, it being remarked that if the man's salary was changed during the period he was allowed to deposit 5 per cent of the new salary. In closing out the account as of July 1, 1914, it was found that such a man's deposits, with interest compounded according to the rules, amounted to $209.82. For this he was entitled to two full shares of the Commonwealth Edison Company stock at par, the balance of $9.82 being deposited to the subscriber's new account in a new five-year savings fund known as Series B. It may be remarked that the company's stock is now paying 8 per cent.

In addition to this $209.82, however, the committee sent a check for $44.06 as the subscriber's pro rata share of the profit made in handling the fund during the period covered by the Series A fund. This profit was made from the fact that the dividend rate was raised twice during the five-year period; also from the fact that a 10 per cent stock dividend was issued, while other stock was issued at par. In all of these profits the stock held by the committee for the benefit of the Employees' Savings Fund participated. Thus the entire cash receipts of the man who deposited $180 were $253.88. However, the two shares of Commonwealth stock are actually worth at the present (July 1) market value $270—they could be taken by the owner and sold for that—so that the entire return on the final investment of $180 was $323.88. This shows a profit of $143.88, or $28.78 for each of the five years, which is an annual profit of 31 per cent on the average investment of $90.

Conditions of Eligibility for Savings Fund

To be eligible for the savings fund the employees of the company must have been in the service of the organization for one year or more. On May 1, 1914, there were 3132 eligibles in the company. Of these 2051 were members of the Employees' Savings Fund. Up to July 1, 1914, the amount actually paid into the fund by depositors amounted (with interest) to about $325,000. On the date mentioned 314 accounts came to maturity, and this means that about 275 new stockholders were added to the company's list, the others being already stockholders.

As other accounts mature (as they will from day to day) under the Series A arrangement, other new stockholders will be added, until a total of about 2000 new stockholders will have been added through the means of this fund. The Series A fund will terminate on July 1, 1919, and the Series B fund will terminate on the same date.

Plan of the New Series B Fund

The arrangement for the new Series B fund, just begun, are somewhat different from those for the original Series A fund. The investment price of the company's stock for the Series B five-year period is fixed at $120 per share instead of the par value fixed in the Series A arrangement. However, this is still fifteen points below the present market value. It is provided that if during the five-year period the subscriber is placed under the service-annuity rules of the company his subscription in the savings fund shall cease, and he may withdraw his deposits, together with 6 per cent compound interest. The rate of interest in the Series B fund, as in Series A, is 6 per cent compounded semi-annually. In the Series B fund the subscription periods of all subscribers terminate at the same time—that is, on July 1, 1919—unless sooner terminated according to the carefully drawn rules and regulations of the fund.

The committee in charge of the Employees' Savings Fund consists of Messrs. Samuel Insull, Henry A. Blair, Benjamin Carpenter, Louis A. Ferguson, J. H. Goehst, W. L. Abbott and P. Junkersfeld. Mr. Insull is chairman of the committee and Mr. William A. Fox, vice-president of the Commonwealth Edison Company, in charge of finances, securities and claims, is treasurer of the Employees' Savings Fund. Mr. John F. Gilchrist is secretary of the committee and Mr. John H. Gulick is auditor.

Slow Progress of Trust Legislation

With at times but fifteen or twenty Senators present, the bill reported by Senator Newlands' committee providing for the proposed federal trade commission has continued under debate during the past week. It is said in the Senate that the much-discussed fifth section of the bill, which provides that "unfair competition" shall be unlawful and leaves to the commission the determination of what is "unfair competition," is to remain in the bill. The language of the section may be changed in some respects, but the principle, it is stated, is to remain in the measure. This information is the result of a canvass of the Senate interstate commerce committee, which reported the bill.

At the time the bill was reported there was but one Democrat on the committee who voted against this section. He has since changed his mind and has decided to support the section, and it is announced that a number of Republican senators also will support the section, including Senator Cummins.

It is expected that the language of the section will be changed to make it clear that the courts are to have the final decision in all matters which the proposed commission considers involve "unfair competition."

Speaking on this section of the bill, Senator Borah, who is leading the debate against the whole bill in the Senate, declared that the Sherman law compels competition, while the fifth section of the proposed law will make some forms of competition illegal. He declared that the ultimate result of the proposed law will be to

provide a buffer against the enforcement of the Sherman law.

Senator Newlands, who is leading the fight for the bill, replied to Senator Borah, as follows:

"It seems to me that it would be folly for us to attempt to define each practice so as to cover the field, because we have the testimony of experts in business that unfair competition is so multiform that if we condemn twenty practices to-day twenty more will be invented to-morrow. So we must have some general rule."

Senator Newlands, while admitting that combinations had got rid of much "brutal competition," declared that they had accomplished this end by creating monopoly.

"We wish to get rid of it, not by creating a monopoly, but by establishing a fair competition that is in good accord with the moral law," said Senator Newlands.

The Senate is having great difficulty in maintaining a quorum to debate the bill. A number of Senators have gone to Europe, and others are at their homes in the different states. During the week the charge was made on the floor of the Senate that the attempt to pass legislation of such great importance with so few members of the Senate in Washington to discuss it and work upon framing it constitutes "a public scandal."

The Democratic Senate caucus has met and passed a resolution that Congress shall stay in Washington at this session until the anti-trust legislation included in the so-called administration program has been passed. This is binding upon the Democrats, who are in the majority.

Big Meadows Dam in Service

Following the completion of the new hydraulic-fill dam at Big Meadows, Cal., the site was visited recently by a party of Great Western Power Company officials, including Messrs. Mortimer Fleishhacker, president; Guy C. Earl, vice-president; E. W. Beardsley, superintendent, and J. M. Howard, chief engineer. Mr. Fleishhacker reported that the reservoir now covers an area of about 30 sq. miles, being 10 miles long and about 8 miles in width at the widest point. The party traversed the lake in a tug, and it was noted that in the tributary watershed only a small portion of the snow had melted, although the 250,000 acre-ft. of water in the lake was collected in May and an overflow of several thousand second-feet has continued since. Mr. Fleishhacker said he had no doubt that there would be an ample water supply for the ultimate storage capacity which the company plans to provide by adding 15 ft. to the height of the dam and thereby flooding an additional 12 sq. miles. The spillway in the dam is made large enough to pass 50,000 second-ft., or five times the amount of the maximum flood on record. Within a distance of 12 miles below the reservoir there is a total drop in the stream bed of over 2000 ft.

Electric Illumination Supplants Pyrotechnic Displays on New York's Fourth

Extensive and elaborate electrical illumination of parks and public buildings was employed in New York on July 4 as a "safe and sane" substitute for dangerous forms of patriotic expression. More than 26,000 red, white and blue incandescent lamps having an aggregate rating of over 1,000,000 cp were used for decorative purposes on Manhattan Island alone. These included a number of very large high-efficiency nitrogen-filled lamps. The famous old City Hall, as shown by the accompanying illustration, was one of the buildings to be elaborately decorated. Cornices, balconies and water tables were illuminated so as to present dazzling bands of light, and strings of incandescent lamps were employed to outline the tower and dome.

Numerous other public buildings and monuments were similarly lighted, while parks devoted to public speaking, moving pictures, exhibitions of folk dancing and other entertainments were decorated with festoons of colored lamps. The lamps, wiring and energy for the illumination of the municipal buildings were furnished gratis by the New York Edison Company.

NEW YORK CITY HALL IN FOURTH OF JULY ATTIRE

Curtis Steam Turbine Development

Much interesting information concerning the evolution of the steam turbine was given in an opinion filed in connection with a suit concerning United States patents Nos. 566,969 and 595,435, issued on Sept. 2, 1896, and Dec. 14, 1897, to Mr. Charles G. Curtis. The opinion was rendered by Circuit Judge J. Buffington on an appeal from the District Court of the United States for the Eastern District of Pennsylvania in a suit brought by the International Curtis Marine Turbine Company and the Curtis Marine Turbine Company of the United States against the William Cramp & Sons Ship & Engine Building Company.

It seems that the pioneer work in the development of commercial turbines was carried on along two radically different lines. In 1884 the Hon. C. A. Parsons took out British patent No. 6735 covering the practical application of the reaction principle as applied to steam turbines. In its essential aspects to-day the Parsons turbine closely follows the ideas of its inventor. In 1889 De Laval filed application for a patent on a turbine of the impulse type.

Parsons and De Laval were successful in overcoming the objection common to both types, that is, the inherently high rotative speed of the machines compared with the speed of the electric generators or other apparatus they were to drive. Parsons succeeded in reducing the speed to practical limits by using a very large number of reaction blades, expanding the steam by small steps through each. De Laval on the other hand, using a single wheel, developed his flexible shaft which permitted the wheel to run at very high speed, and then perfected a reduction gear to transmit the power at lower speed to the driven apparatus.

It was in 1896 that Mr. C. G. Curtis secured patent

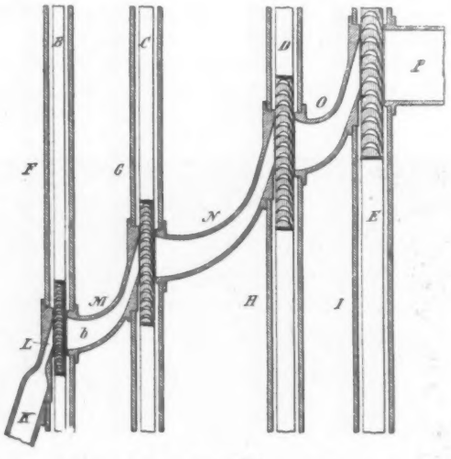


FIG. 1—TURBINE STAGING

No. 566,969, covering a turbine of characteristics different from those of either of his predecessors. His original ideas are well expressed in the testimony recently submitted in the patent suit referred to above. The point at issue in this litigation was whether or not the original Curtis patent covered impulse turbines using more than one stage, with one or more rotating rows of buckets per stage. In testifying in this case Mr. Curtis said:

"After giving the subject a great deal of thought, it seemed to me that it would be possible to devise a machine which could be run at a much lower speed of revolution than any turbine of which I was aware, that would have an even higher efficiency, sufficiently high to enable it to take the place of the steam engine in large units. At the same time the machine could be made very rugged and mechanically simple, and the necessity for small blade or bucket clearances eliminated. I remember being very much struck with the fact that no machine having these characteristics had yet been produced, although a great amount of thought and experiment seemed to have been devoted to the subject."

The object which Curtis had in mind was the production of a highly efficient machine of comparatively low speed. His original patent shows that this was to be accomplished in one of two ways, or a combination of both. The patent reads:

"The method by which the turbine of my present invention operates consists in converting the pressure

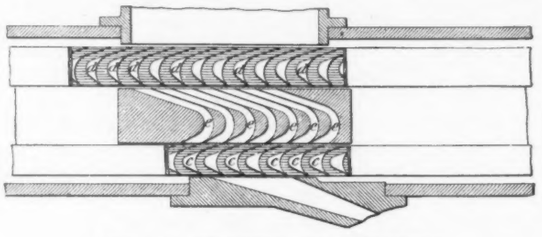


FIG. 2—VELOCITY COMPOUNDING

of the fluid into *vis viva* by stages and utilizing the *vis viva* developed at each stage by passing the fluid through rotating vanes, the speed of revolution of which is adapted to abstract substantially all or a large portion of the velocity. . . . The movable elements of the apparatus in which the *vis viva* developed at each stage is utilized may consist of single sets of rotating vanes, or of two or more such sets with intermediate stationary vanes or passages, or of two or more sets of rotating vanes, connected to different shafts."

As shown in Fig. 1, which forms part of the original patent, each stage was to consist of a single row of rotating buckets connected to the following stage by a suitable nozzle or nozzles. The idea of velocity compounding—that is, using the velocity acquired in one set of nozzles in more than one rotating row of buckets in the same stage—is also shown in Fig. 2, taken from the patent specifications.

The Court of Appeals in its decision in the patent suit referred to states:

"This brings us to the question, Was Curtis' disclosure of thus pressure-staging an impulse turbine alone, or the combining of such pressure staging with velocity compounding, inventive? After a patient and thorough study of this record, we are satisfied it was. When Curtis started the work which eventuated in this patent the steam-turbine problem was involved in complexity and uncertainty. The pioneer work of Parsons and De Laval was based on machines wholly unlike in basis principle of operation, and this dissimilarity rather tended to confuse and mislead those who sought improvement in lines common to both."

The court finally concludes: "The plaintiffs are entitled to a decree sustaining patent No. 566,969, so far as indicated in the foregoing opinion."

With this court decision sustaining the original patent, it is possible to define briefly the Curtis turbine of patent No. 566,969 as covering a steam turbine of the impulse type, employing two or more pressure stages, each pressure stage containing one or more rows of revolving buckets.

As actually constructed for commercial work, the first Curtis turbines built had several velocity stages for each pressure stage. This was due to the necessity for slow speed, both to permit a generator design not

too far beyond previous practice and to allow the wheel and bucket stresses to come well within the known limitations of the materials available at that time. Thus the first three 5000-kw turbines installed by the Chicago Edison Company (now the Commonwealth Edison Company) were built with two stages, each stage containing four rows of revolving buckets. Later developments, together with improvements in wheel and bucket construction, showed that greater economy could be obtained with more pressure stages and fewer velocity stages. The fourth 5000-kw machine installed in Chicago had five stages, each containing two rows of revolving buckets. Still later development indicated that some of the stages could be profitably constructed with but a single row of buckets, as set forth in Curtis' early patent. The present practice in building large Curtis turbines is to employ not more than two rows in any stage, and under certain conditions governed by size, speed, etc., a large number of stages contain a single row of rotating buckets.

Several of the more recent large installations have machines of this latter construction. Notable among these is the installation recently completed at Hauto, Pa., by the Lehigh Navigation Electric Company and described in the *Electrical World* of May 9, 1914. The generating equipment consists of three 12,500-kw Curtis turbines built by the General Electric Company. In these machines the first stage consists of two rows of buckets, while the following stages each contain a single row. The efficiency obtained by this arrangement is such that these three units and a number of similar machines both larger and smaller have proved to be the most economical turbines so far installed in this country.

Progress of Department of Machinery, Panama-Pacific International Exposition

Since the recent return of Lieut. George W. Danforth, chief of the department of machinery of the Panama-Pacific International Exposition, from an extended tour of the Eastern States, the department has been actively engaged upon the allotment of space in the completed Palace of Machinery. As there were far too many applicants, each asking for a large amount of space, to be accommodated in the area of the building—369,600 sq. ft.—it became necessary to consider carefully each application so that all amounts of space might be appreciably reduced. The task is now, however, practically completed and the final allotments are being made.

The exhibits will comprise what it is said will be the finest collection of electrical and machinery exhibits ever assembled under one roof, and the exhibitors are co-operating with the Department of Machinery in associating their exhibits with others so as to permit of complete operation and demonstration of the working of the various machines and electrical exhibits.

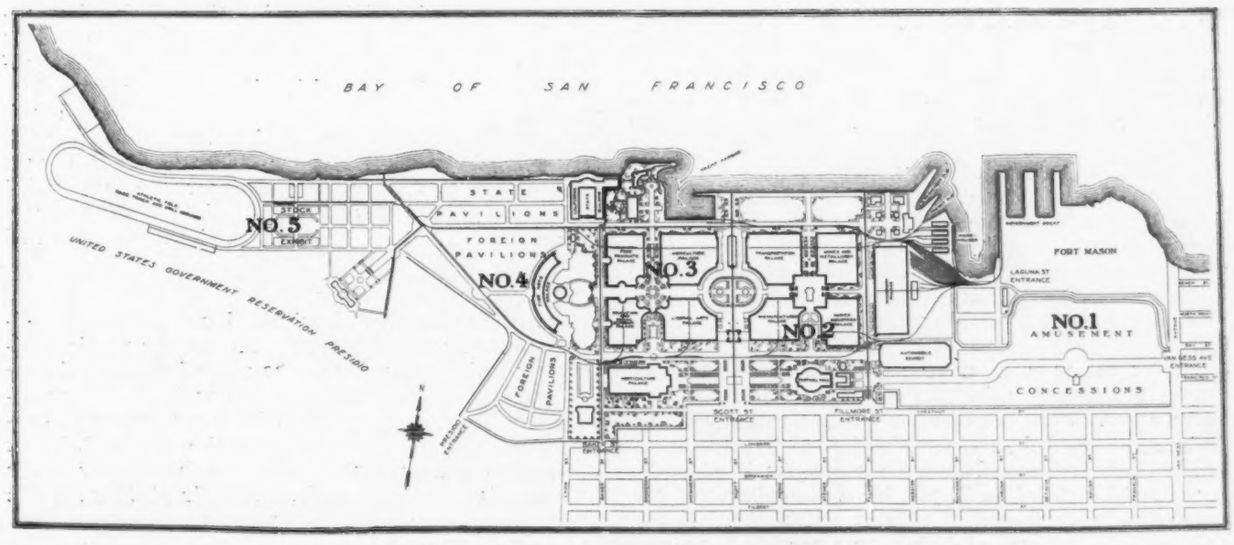
On April 1 preliminary work was started on the installation of the first exhibit, a 500-hp marine Diesel engine, by the Busch-Sulzer Brothers Diesel Engine Company, and the first pile for the foundation was driven with appropriate ceremonies on May 27 by Capt. Asher Carter Baker, director of the division of exhibits. The installation will cost $70,000.

The entrances to the Palace of Machinery will be handsomely decorated with palms and shrubs which will afford a pleasing surprise to those who may expect to find only a display of machinery. To attract the non-technical visitor many spectacular exhibits have been arranged, and it is believed that the "Palace" may be made the most popular of all the exhibit buildings. Several of the exhibitors have arranged, through the operation of pumps, etc., beautiful and artistic effects, such as waterfalls and illuminated fountains.

The latest and most modern approved methods of illumination will be used in connection with the exhibits in the Palace of Machinery and will be of interest to the layman as well as to the student and those vitally interested in such affairs. One phase will be especially interesting—the isolated electric-house-lighting systems for farm use compared with the most complicated systems in use for city lighting.

The testing of high-potential insulators and transformers will be made possible by the arrangements which have been made with a large manufacturer of high-voltage testing apparatus, and many spectacular effects have been prepared by the use of such instruments.

A feature of the Palace of Machinery will be the methods employed for the convenience of the visitors. A number of plans are now being tested to insure to engineers and students the opportunity to make a careful examination of each exhibit in privacy and comfort. Reception spaces will be provided in connection with each exhibit and equipped with suitable fixtures which will enable technical visitors to prepare notes on the various features.



PLAN OF PANAMA-PACIFIC INTERNATIONAL EXPOSITION GROUNDS

All of the working exhibits—and it is now certain that a large percentage will be in actual operation—will be equipped with the latest "safety-first" devices, and these guards will form one of the most interesting exhibits to the engineer and manufacturer.

The Department of Machinery of the Exposition will soon take formal possession of the offices which have been built inside the building on a mezzanine floor and will remain there until the close of the Exposition. The gates of the Exposition will open on Feb. 20, 1915, and will close on Dec. 4, 1915. Nine of the eleven principal exhibit buildings are now completed, and the others will be finished shortly.

Mutual Liability Insurance Company in New York

Electrical and gas companies in New York State have organized a mutual-liability insurance company under the compulsory workingmen's compensation law which went into effect on July 1. The company has been named the Utilities Mutual Insurance Company, and it began business on July 1 with sixty-nine policies written, covering about 3000 employees.

The organization of the company was made possible largely by the past work of the Empire State Gas & Electric Association, which has maintained friendly relations between the various companies and has promoted unity of action and co-operative effort.

The New York law requires insurance of employees against injuries and provides four ways in which this may be obtained. For the State fund the rates of insurance have been set at a little over 8 per cent below the rates which may be charged by stock or mutual companies. There are also the stock companies and the mutual companies. The minimum rates which may be charged by stock and mutual companies are fixed by the State. There is self-insurance under certain restrictions prescribed by the State.

Each of the four methods was discussed fully before it was decided that as matters stood in New York State, at least, the plan of a mutual company held out the prospects of greatest benefits.

The by-laws of the company provide for at least thirteen directors, eleven of whom must be policy-holders. Each policy-holder is a member of the company and has one vote with one additional vote for every 500 employees, but in no case can a member have more than twenty votes.

In addition to fixing the minimum rates which may be charged for each class of risk the State determines the maximum percentage of premiums which may be devoted to operating and administrative expenses. As an added precaution the directors have fixed the rates at 10 per cent higher than the minimum set by the State.

The State department has ruled that operating and administrative expenses of mutual companies shall not exceed 23 1/3 per cent of the premiums. A "catastrophe surplus" must be set aside at the rate of 10 per cent of the premiums until it shall amount to $100,000, and thereafter at the rate of 5 per cent until it shall in amount comply with the provisions of the law.

Profits accumulated after paying all losses and expenses and setting aside the necessary reserves are to be returned to the members in the form of dividends. It is also provided that, as a still further measure of safety, a "certificate holders' surplus fund" shall be set up. The object is to provide a secondary defense against any catastrophe, thereby strengthening the policies. At the end of each year a certificate will be given to each member setting forth his interest in the fund. While the fund belongs to the holders of the certificates, the company reserves the right to draw upon it under certain extraordinary circumstances which are stated in the by-laws.

The company will promulgate and may modify from time to time standards for construction and for methods of operation, with a view to reduction in the number of accidents. It will circulate information among its members in regard to accidents, so that measures may be taken to prevent repetition. It will employ inspectors to visit the plants of all members or applicants for membership. The merit rating system will be employed, which will give added incentive to the members to bring their plants and systems up to standard and to maintain a high state of efficiency in their accident prevention work.

Of the sixty-nine members on July 1 forty-five are electric companies, seven artificial gas companies, ten gas and electric companies, and seven natural gas companies. The officers are: President, Mr. J. T. Hutchings, general manager Rochester Railway & Light Company; vice-president, Mr. J. C. DeLong, president Syracuse Lighting Company; secretary and treasurer, Mr. C. H. B. Chapin, secretary Empire State Gas & Electric Association. The general agents are Parsons & Company, and the company's headquarters are at 51 Wall Street, New York City.

PUBLIC SERVICE COMMISSION NEWS

Ohio Commission

The Union Gas & Electric Company, of Cincinnati, has appealed to the Ohio Public Utilities Commission for relief from an ordinance recently passed by the Cincinnati City Council requiring the company to furnish electric light service to several suburbs. The company complains that the ordinance is unreasonable in that it would require costly extensions which the amount of business available in the suburbs would not justify.

Maryland Commission

Mr. Philip D. Laird, chairman of the Maryland Public Service Commission, has sent his resignation to Governor Goldsborough, effective on Aug. 1. In resigning Mr. Laird is carrying out a determination made about a year ago. The hard work, which is constantly increasing, is making inroads on his health.

The Maryland Public Service Commission has rejected the petition of the residents of Roslyn asking that the Consolidated Gas, Electric Light & Power Company be required to extend its lines to that point. The petition was based upon an agreement with the Patapsco Electric Company, which was absorbed by the consolidated company. Under this agreement it was said that the electric-lighting service was to be extended to Roslyn and the petitioners asked that the contract be observed by the commission and the Consolidated company.

Idaho Commission

The State Supreme Court has handed down a decision upholding the constitutionality of the public utilities law and the legality of the acts of the commission The cases involved were those in which the commission issued orders refusing to issue certificates of convenience and necessity for the Idaho Power & Light Company to enter Twin Falls and the Beaver River company to enter Pocatello. The Great Shoshone & Twin Falls Water Power Company was already rendering service in Twin Falls, and the Southern Idaho Water Power Company in Pocatello.

Wisconsin Commission

The commission has given its approval to the purchase of the Dodgeville Electric Light & Power Company by the Mineral Point Public Service Company. The price determined upon is $15,700. The Oakfield Light & Power Company has been authorized to issue $10,000 of 6 per cent bonds for the purpose of paying outstanding indebtedness and furnishing funds for the construction of a transmission line from the company's distribution system to the terminus of the lines of the Eastern Wisconsin Railway, Light & Power Company at Fond du Lac, with the necessary substation equipment. The Oakfield company plans to purchase its power from the Eastern Wisconsin Railway, Light & Power Company.

Indiana Commission

Present interest centering in the Public Service Commission of Indiana turns entirely on the developments in the cases relative to the Indianapolis lighting situation. Following the filing of petitions for revision of rates the commission's valuations have been finished.

Much controversy between the city administration and the lighting companies has resulted from the recent contract for city lighting for the next ten years at rates approximately one-half of those formerly paid to the Indianapolis Light & Heat Company. The Merchants' Heat & Light Company was the successful bidder for the new contract. Meanwhile a test suit is pending to determine whether the Board of Public Works has power to conclude such a contract or whether the rate-making provisions are entirely in the hands of the commission. In argument in court Corporation Counsel W. A. Pickens admitted that the commission has authority as to rate-making contracts between cities and public service corporations. The commission members say that they will serve notice on the local companies of the completion of the valuations at once and that the hearings on the cases will begin in Indianapolis, probably before Aug. 1.

Attorney-General Thomas M. Honan has given an opinion to the Public Service Commission, interpreting the public service statute on several points.

New York Commissions

In preparation for the proposed appraisal of property of the New York Telephone Company, a preliminary survey of the property has been sent to the New York Public Service Commission, Second District, by the committee appointed by the company, of which Mr. F. B. H. Paine is chairman. The company believes that it is necessary to make a valuation of the entire property of the company within New York State, in order to determine the value of the property within New York City.

The commission thinks that an appraisal of the entire property in the State is unnecessary. Its special counsel, Mr. D. B. Murphy and Mr. William McClellan, who was appointed recently confidential engineer for this work, are now studying the preliminary survey sent to the commission by the committee acting for the company. Mr. Paine and Mr. Swayze, general counsel of the company, say that it is not possible to separate the use to which the New York City property is put for toll and local exchange service, so as to give a basis for making local rates in New York City which will stand in court.

The committee will go ahead with the work of valuation. It is believed that little, if any, more time will be required to make a valuation of the property within the entire State than to value the city property alone. Much the largest part of the time will be required for the property in the city of New York, so that the work in other districts will not have any effect on the prosecution of that in New York City. It is proposed to divide the State into six divisions. A large amount of time will be required for study of the accounts.

New Hampshire Commission

The commission has issued an order containing rules prescribing standards for electric service and providing for the testing of meters and otherwise regulating the service of electric utilities. The order applies to each public utility engaged in the generation, transmission or sale of electric-energy ultimately sold to the public which in any one year shall have generated, transmitted or sold more than 25,000 kw-hr. or shall have had more than twenty-five consumers. The order took effect on July 1, 1914. Ninety days is fixed as a reasonable time within which the companies shall comply with the rules relating to meter-testing equipment and voltage survey.

New Jersey Commission

The order of the Board of Public Utility Commissioners of New Jersey in the matter of the complaint of Max Taub against the Public Service Electric Company is based on the previous decisions of the board in regard to the grounding of secondaries. The position of the board upon the questions involved was stated in a report made on May 17, 1912. However, complaints have been filed repeatedly since then. Owing to the misunderstanding of the position of the board, which seems to persist, it was considered advisable that the entire situation be reviewed and the conclusions of the board restated, so that there may be no reasonable ground hereafter for filing like complaints. The complaint on which the decision was based is one of a series made from time to time by residents of Hoboken, who employed Mr. Joseph McBride, an electrical contractor, to wire their premises, and who had been refused service because of the unqualified refusal of the contractor to provide for the grounding of secondaries of transformers inside the premises of the complainants, as required by the rule of the company.

The decision quotes from a report on the alternating-current distributing system in Hoboken made by Prof. Albert F. Ganz, of the Stevens Institute of Technology, on Dec. 2, 1912, to the Board of Water Commissioners of Hoboken. It also quotes from a report made to the New Jersey commission on March 30, 1912, by Prof. Malcolm MacLaren, of the school of electrical engineering of Princeton University. Extracts from the reports of both Professor Ganz and Professor MacLaren are given. Both point out that until comparatively recently expert opinion upon this matter has been divided. Each, however, asserts that the weight of expert opinion, both here and abroad, now strongly favors the grounding of secondaries of transformers. Both accord in the opinion that it is better to connect the ground wire to the service pipe inside of a building than to make the connection to the underground pipes in the street. The rules contained in the 1913 edition of the National Electrical Code regarding the grounding of secondaries were adopted by the board as of Jan. 1, 1914, for all new connections. The rule of the Public Service Electric Company is in accord with those rules. In the judgment of the board, it is not necessary that the consent of the municipality be obtained to make a connection.

The board finds nothing in the record to change the general rule regarding this matter put into effect by its order, which became effective on Jan. 1, 1914. Because the rule of the company is in accord with the rule established by the board, and because of the considerations set forth in the decision, the board finds the rule to be reasonable and orders the complaint dismissed.

Current News Notes

Elysian Delights to Be Augmented.—The village of Elysian, about 18 miles west of Faribault, Minn., has granted an electrical franchise to the Consumers' Power Company of St. Paul. As soon as water-pumping and city lighting contracts have been secured the company will begin the construction of the distribution lines within the village.

* * *

Long Service Employees Distinguished with Badges.—The Commonwealth Edison Company, which has for some years furnished its employees with badges indicating the length of their service, reports that there are now 180 men who have been with the company five years or longer. Of these 121 have served five years, thirty-nine ten years, twelve fifteen years, ten twenty years, and seven twenty-five years.

* * *

Electrical Show for Lansing, Mich.—An electrical show is planned for Lansing, Mich., Aug. 17 to 20, under the auspices of the Michigan Power Company. A two-story brick building containing 8000 sq. ft. of floor space will house the exhibits. Manufacturers of electrical devices who desire to display their products are asked to address Mr. D. R. Thomas, general manager of the Michigan Power Company.

* * *

Electro-Medical Exhibit.—During July the New York Edison Company is displaying an extensive exhibit of electro-therapeutic apparatus and devices at its new showrooms, Irving Place and Fifteenth Street, New York City. Physicians, surgeons and dentists have been invited to inspect the display of Roentgen-ray apparatus, compressed-air outfits, bath cabinets, electric-lighted instruments, anæsthetizing machines, etc.

* * *

Panama's 600-ft. Radio Station Nearing Completion.—The three 600-ft. steel towers for the government wireless-telegraph station on the Isthmus of Panama are now nearing completion, and it is hoped to have messages exchanged shortly between the Canal Zone and the Arlington station, near Washington, D. C. Another similar station is being erected at Tutuila, Samoan Islands, and others will be provided at San Francisco, Honolulu and Manila.

* * *

For a National "Electric Vehicle Day."—Mr. Robert Montgomery, manager of the commercial department of the Louisville (Ky.) Gas & Electric Company, has proposed that a certain day be set aside throughout the country as "Electric Vehicle Day." On such a day, preferably a holiday, Mr. Montgomery suggests that an electric-vehicle parade be held to demonstrate the extent to which electricity is used for driving passenger and commercial cars. Prizes might also be awarded by local concerns for the most attractively decorated truck or pleasure car.

* * *

Turbines, Tariff and Salt Sea Air.—It is of interest to note that the English-built 25,000-kw Parsons turbo-alternator set, installation of which has just been completed by the Commonwealth Edison Company, Chicago, was received in this country late last summer shortly before the new tariff law went into effect. To gain the saving in customs duties possible under the new tariff the turbine was therefore held in bond for about a month until the date when the act went into force. Upon unpacking the set at the end of this period it was found, however, that the insulation of the machine had absorbed considerable salt moisture during its sea voyage across the Atlantic, so that the armature end-turns had to be reinsulated before the turbo-generator could be made ready for use.

* * *

The Electric-Lighting Salesman in Fiction.—A combination illuminating engineer and electric-service contract agent is the hero of Richard Washburn Child's story, "The Game of Light," in *Everybody's Magazine* for July. Allowing for the rather-to-be-expected short-story exaggeration, the yarn is an interesting one. And it is worthy of commendation for the correct use of electrical terms. The principal character is a lighting enthusiast. To the lovely daughter of the president of the company, and of course the heroine, he says this: "You don't realize how much light affects life, do you? It's marvelous! Houses lighted the wrong way hurt the souls of people who live in 'em. I'll bet I have put installations in people's private dining-rooms and parlors that have prevented divorces. Correct lighting will make parents bring up children the right way!"

* * *

SOCIETY MEETINGS

The Engineer in Public Service.—At the annual meeting of the American Society of Mechanical Engineers, to be held in New York from Dec. 1 to 4, one entire session, that of Dec. 3, will be devoted to a discussion of the general subject of the engineer in public service. Problems in municipal engineering of interest to the mechanical engineer will also be considered.

* * *

Arkansas Electric Club's Outing.—The Hot Springs (Ark.) Electric Service Club on June 27 entertained the Little Rock (Ark.) Electric Club with a chicken dinner and outing at Riverview Park, Hot Springs. Felicitous addresses were made by both hosts and guests, including Messrs. S. E. Dillon, C. J. Griffith, Arthur Smith, W. J. Tharp, T. E. Bragg, George Peebles and others.

* * *

Kentucky Contractors' Association.—Kentucky members of the National Electrical Contractors' Association recently organized a state branch at Louisville, electing Mr. Gus Albrecht, Louisville, president, and Mr. S. D. Dalby, Paducah, vice-president. Mr. F. E. Good, of the F. A. Clegg Company, Louisville, was named to represent the state section at the Detroit convention of the national association.

* * *

Co-operation in Technical Advertising.—"How the Publisher and the Advertising Manager of the Manufacturer Can Co-operate to the Best Advantage," was the title of a paper presented at the trade and technical-publication session of the recent Toronto convention of the Associated Advertising Clubs by Mr. A. N. Fox, advertising manager of the Benjamin Electric Manufacturing Company, Chicago, Ill.

* * *

American Peat Society.—The eighth annual meeting of the American Peat Society will be held at the Commercial Club, Duluth, Minn., Aug. 20, 21 and 22. Among the papers to be read is one on "Developments of the Peat Gas Producer," by Mr. F. B. Haanel, of the Department of Mines, Ottawa, Canada, and one on "The Conversion of Peat Into Fuel," by Prof. C. A. Davis, of the United States Bureau of Mines, Washington, D. C. The secretary of the society is Mr. Julius Bordollo, Kingsbridge, New York City.

Boston Edison General-Service Buildings—I

By H. S. Knowlton

THE Edison Electric Illuminating Company of Boston, Mass., has lately opened for business a general service plant which represents the most comprehensive solution thus far achieved in the central-station industry of the important problem of handling efficiently those features of its work directly associated with installation, maintenance, transportation, testing and employees' welfare. The initial arrangement of buildings and equipment, the provision for future expansion, the internal departmental scheme of operation, and the perfection of detail found in every part of the property, express the most advanced ideas in scientific management and illustrate at every turn the advantages of designing such an establishment *de novo* instead of attempting to meet the auxiliary service requirements of a rapidly developing system by existing and outgrown accommodations. Upon a tract of land previously unoccupied by company plant there has been created a great industrial establishment, unique in scope, which represents an investment of about a million dollars, and which sets a new standard of service in the industry of electrical energy supply.

The rapid growth of the company during the last ten years, and particularly the expansion of its business in suburban districts, rendered the service facilities of a few years ago wholly inadequate to meet the present conditions and made necessary the construction of the new plant. The company was originally organized to supply electrical energy in the city of Boston, but practically ever since the beginning its business has been expanding into territory outside the metropolitan center, resulting in the acquisition of many outside electric generating plants and the centralization of their services until the company is now one of the largest on the continent.

Seven hundred square miles of city and suburban territory are now served by the system, the lines of which extend from Boston as a center to the Rhode Island state line on the southwest and to the Chelmsford-Carlisle line on the northwest, the maximum distance of transmission from the principal generating station in South Boston being about 40 miles. Boston and its suburbs are radial in plan, and the company's territory is divided into seven districts for administrative purposes. In these districts the company serves about forty municipalities, with a combined population of 1,500,000.

The territory above mentioned contains company property valued at over $30,000,000, in office buildings, generating stations and substations, storehouses, pole yards, shops, wire, cable and supplies, besides distribution equipment. The taking over of many small suburban plants, with equipment of varying value, has further complicated the problem of handling supplies efficiently, but from the first the property has been developed upon a consistent basis. The new service plant is therefore designed to fit the needs of the ter-

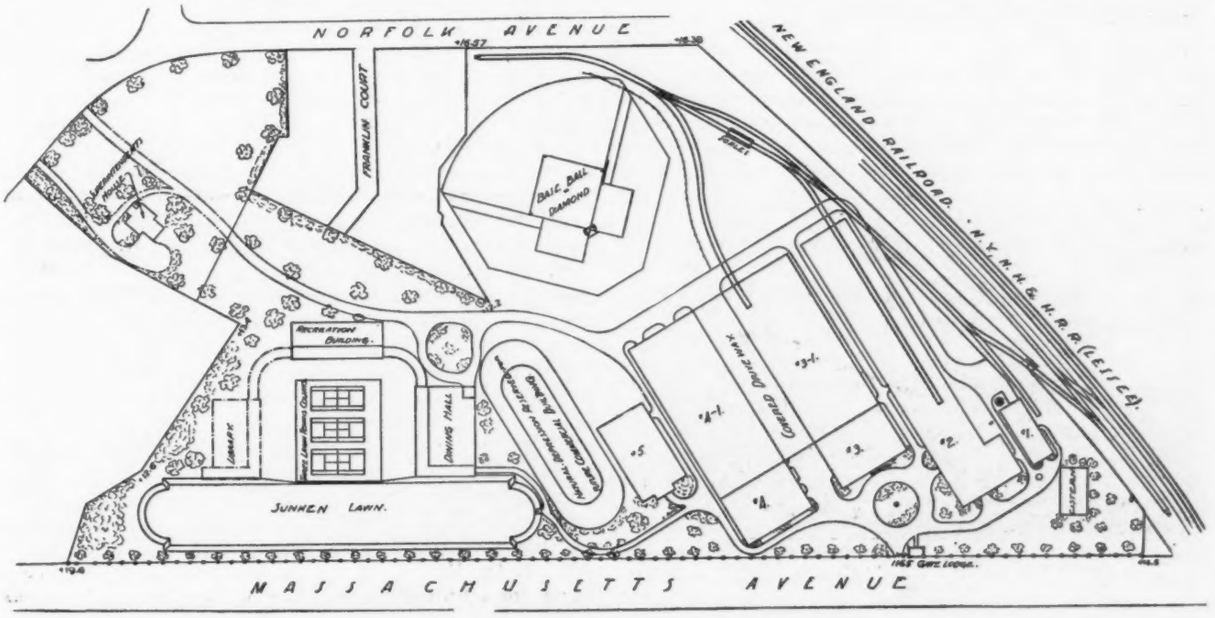


FIG. 1—PLAN OF EDISON SERVICE BU''LDINGS, BOSTON

FIG. 2—GENERAL VIEW IN HEAVY-STOCK ROOM

ritory as a whole, to supplement the facilities offered by local districts and, in a word, to dominate the general service activities of the entire company from a central point of administration and departure. The site selected was the most convenient which could be found in proximity to the heart of Boston, the plant being situated on Massachusetts Avenue, at the east of the Midland division of the New York, New Haven & Hartford Railroad. Its distance from the downtown district is about two miles. A private side track enters the property from the railroad.

General Features of the Group

Eight buildings have been erected, and close attention has been given to their architectural appearance as well as to their practical use. They are principally of reinforced-concrete construction, with offices finished in mission style. The group consists of a combined substation and heating plant, quarters for linemen and supplies, the administration offices and stockrooms, a garage, repair shops, the laboratory and the welfare buildings. About 12 acres are at present utilized, and ample provision is being made for social and athletic activities among employees. The latter include a baseball diamond, tennis courts and a green for clock golf.

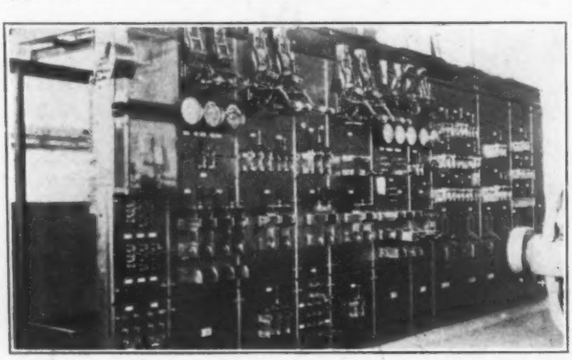


FIG. 3—LOW-TENSION SWITCHBOARD IN GROUP SUBSTATION

The plant is most advantageously situated with respect to load centers, bases of supplies and territorial layout. Much of the work formerly done in separated buildings is now concentrated at Massachusetts Avenue, and valuable space in the downtown district has been released for other uses by the transfer of the laboratory, meter shop and other department activities to the service plant. Stockroom consolidation, improved fire protection, directly connected motor drives, modern industrial lighting equipment, economical routing of material, unit storeroom apparatus and many other features resulting from long and thorough study of the company's general service are embodied in the installation.

The industrial engineering problem at the service buildings was solved with the co-operation of Mr. Frederick A. Waldron, consulting engineer, New York City, who also drew the plans for the industrial buildings; the consulting architects were Bigelow & Wadsworth, Boston, and the construction work was done by the Stone & Webster Engineering Corporation, Boston, with the exception of the welfare buildings, which were handled by separate contract. General oversight of the entire development was given by the construction bureau of the Edison company.

Referring to the general plan of the property, Building No. 1 is the heating plant and substation (measuring 37 ft. by 96 ft. and one story in height); Building No. 2 (75 ft. by 448 ft., one story) is utilized in the storage and handling of heavy stock; Building No. 3 (80 ft. by 110 ft., three stories and basement) contains the administrative offices of the plant and various

bureaus; Building No. 3-1 (110 ft. by 256 ft., at present one story with basement) is utilized for the storage of light stock by the meter, arc-lamp and incandescent lamp divisions of the installation department, in lamp and light line-material storage; Building No. 4, similar to Building No. 3, but with no basement, is the gasoline-car garage, three stories, with maintenance shop and quarters for chauffeurs; Building No. 4-1, one story, similar to No. 3-1, is the electric garage, and Building 5 is the laboratory, 75 ft. by 112 ft., two stories high at the front and one at the rear.

The welfare buildings, now rapidly approaching completion, consist of a dining hall, library and recreation building bordering an attractive court. The various structures are well connected by driveways and spur tracks are carried into the room for heavy stock, the room for light stock and the heating plant. Cars are shifted to and from the railroad main line by a 25-ton Westinghouse-Baldwin electric locomotive owned by the company and equipped with forty-eight cells of "Exide" battery.

The buildings are laid out with uniform bay spacing of 16 ft. between centers, slab and girder construction being used throughout except at elevator and stair wells. As the site is filled-in ground, piling was required throughout the property. The fire protection includes a complete system of automatic sprinklers, hydrants, extinguishers, fire pails and alarm boxes. Water for the underground piping of the property is supplied from the Boston high-pressure system through two 4-in. connections and from the city low-pressure system through a 4-in. connection to a cistern and fire pump.

The high-pressure line carries between 80 lb. and 90 lb. pressure, and the low-pressure line about 45 lb. The cistern has a capacity or 150,000 gal. and is of reinforced-concrete construction, being situated underground near the pump, which is a two-stage centrifugal Underwriters' outfit with a capacity of 1000 gal. per minute at 100 lb. pressure. It is operated by a 100-hp induction motor having duplicate sources of energy supply.

Except for a covered driveway 60 ft. wide between the electric garage and the room for light stock, the plant is equipped throughout with the wet-pipe system of sprinklers, the dry-pipe system being used in the driveway. The hydrants are of the three-way type, and ample hose facilities are provided. Special mention should be made of the gasoline storage facilities. Two qualities of gasoline are used—a 76-deg. grade for torches and a 61.5-deg. grade for automobiles. The latter is stored in two 500-gal. tanks placed underground and 10 ft. away from Building No. 4. These tanks are equipped with the usual filling, measuring and vent pipes, and have a suction pipe leading to a measuring and recording pump on the first floor of the garage, the suction pipe having valves placed so that either tank may be cut off. The tank for the high-test gasoline is also placed underground, the suction pipe leading to a pump just outside an oil room on the first floor of Building No. 3-1.

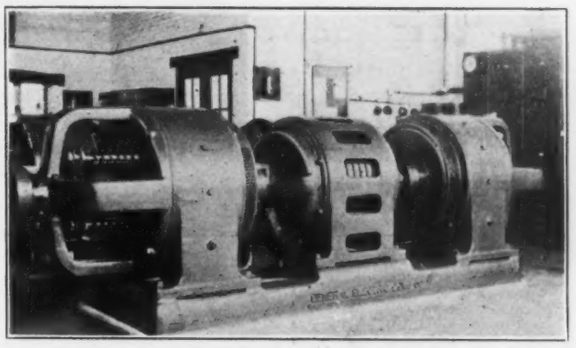


FIG. 5—MOTOR-GENERATOR SET IN SUBSTATION

Heating and Lighting for the Buildings

The service buildings are heated by steam from a battery of four 103-hp Babcock & Wilcox boilers in the local steam plant. To provide hot water for service purposes, a Green fuel economizer was placed in the smoke flue and inserted in the hot-water circulating system. Water is supplied from the city mains to a Kenny rotary pump discharging through a National

FIG. 4—DRIVEWAY ADJOINING STOCKROOM, SHOWING METHOD OF LOADING LAMP AND SUPPLY TRUCKS

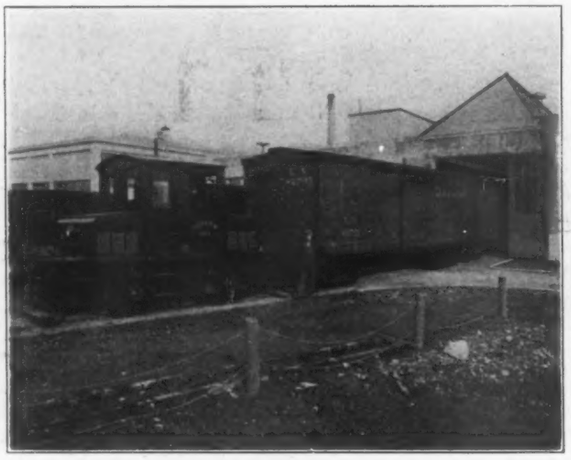


FIG. 6—ELECTRIC LOCOMOTIVE OF BOSTON EDISON COMPANY

feed-water heater to the economizer. The feed-water heater is connected in the return pipe of the heating system and serves as a cooling coil.

When the boilers are shut down during the summer the service water is warmed by three Simplex electrically heated boilers of 20-kw rating and 300 gal. capacity each, a boiler of 500 gal. capacity and 25-kw rating being installed for the garage service. Each of these boilers is supported horizontally and is equipped with three heating units, two of which are at the bottom of the boiler and one at the top. The units at the bottom are employed for steady service, the top unit being placed in circuit in case of a sudden demand for hot water. By a system of valves these boilers are cut out of service when the steam plant is in operation.

As the plant is in the company's alternating-current service district, the general lighting is accomplished by alternating current, but direct current is available for the laboratory, the meter and arc-lamp repair shops, the garage and the locomotive battery-charging panels. About 2 watts per sq. ft. of floor area was allowed in determining the number of outlets required for the lighting system, assuming the use of four 16-cp lamps per outlet. The 16-ft. bay spacing made an outlet spacing of 8 ft. the natural selection. No local switching was considered at the time the work was laid out, the decision being to let this requirement await development and to employ pendent switches as occasion dictated. Panelboards and distribution boxes were made as large as practicable in order to reduce to the minimum the total number required. Conduit was used throughout, being embedded in the floor slabs.

In general, mains are brought into basements and carried to the upper floors through the panel boxes and conduit. Specially designed deep outlet boxes were used to permit laying the conduit above the steel reinforcement and to enter the boxes without bending. This arrangement made it possible to cut and make up most of the runs of conduit on the ground, thereby reducing the time the concrete gangs were kept off the work. Outlet boxes were held in position by a false fixture stud which extended through the form and was secured below by a nut and washer. This was found to be the most satisfactory and economical of all the devices tried.

Stock-Handling Methods

Throughout the service plant special pains have been taken to arrange the various divisions to permit of the minimum handling of material. The principal stockrooms are near the railroad tracks, reducing the amount of trackage required in spotting cars; platform scales are installed in the principal spur track leading into the property so that the smallest amount of shifting is necessary in checking up weights, and the room for heavy stock is provided with two electric cranes of 5 tons and 3 tons lifting capacity, equipped with operators' platforms and covering the entire storage area. Hand trucks are liberally provided for all interior service, and all swinging doors between important aisles and department sections are designed to withstand the shock of pushing such trucks at full speed against the door, so that no time is lost in passing through. Short hauls into and out of the property are also a feature of the company's trucking service, the main entrance being close to the stockrooms.

An important feature is the location of the room for light stock with numerous doors bordering a shipping platform running along the covered driveway between the garage and Building No. 3-1. The platform is 10 ft. wide and 256 ft. in length, and it contains lockers in which are placed packages and materials taken from the stockroom as orders are received during the day, so that a considerable portion of the outgoing loads is practically made up during the absence of the vehicles, greatly reducing the loading time of drivers and delivery wagons or trucks. Excellent elevator facilities are installed in the administration building and the garage building.

Further particulars of the methods of handling stock will be given later, but in passing it is worth noting that these are planned so carefully that a carload of fiber conduit, for example, can be unloaded and placed at an expense of about $4 compared with an outlay of $25 under former conditions. The amount of stock necessary to be carried for a given volume of business is also greatly decreased; transportation costs are cut down, and the time from the receipt of an order from a customer until the shipment of his material has been reduced from five days to one. As a result of the scientific study made of the arrangement and equipment of the buildings, the working area required was reduced to 226,000 sq. ft., or 186,000 sq. ft. less than originally contemplated. Not the least important feature is the concentration of the office staff in well lighted and ventilated buildings.

Substation Equipment

The group substation supplies a varied service, the range of electrical requirements being of particular in-

FIG. 7—PANELS OF HIGH-TENSION SWITCHBOARD

FIG. 8—REGULATOR FOR LABORATORY CIRCUIT

terest. The garage has a capacity of 110 machines, and the economical supply of energy for battery charging presented a considerable problem. The boiler room is designed to accommodate two more units of the present size and contains a set of Howe scales weighing up to 3800 lb., hand firing being employed. A 350-ton concrete coal bunker adjoins the boiler room, coal being delivered by gravity from cars on the local siding. Draft is provided by a Custodis radial-brick stack 125 ft. high and 5 ft. 2 in. in diameter at the top, and the furnaces are equipped with Reagan grates. An 8-in. by 6-in. Blake air compressor, chain-driven by a 7.5-hp, 220-volt induction motor, is provided in the boiler room, the air being used in the meter and arc-lamp shops, in the motor-generator room of the substation and for blowing out tubes. An independent air supply is provided for the garage tire-pumping service. There are two Kenny vacuum pumps, each driven by a 7.5-hp, 220-volt induction motor, in the basement, besides a 2-hp feed pump and a 5-hp economizer circulating-water pump of the same make.

Two three-phase Y-connected 4000-volt lines are brought into the substation through underground conduit from the company's Zeigler Street substation, one line being provided with a neutral wire. Each line is carried to an independent set of buses at the rear of a high-tension switchboard in the substation operating room, the usual disconnecting switches being mounted between asbestos wood barriers 7 in. apart on the wall at the rear of the board. Potential transformer taps are taken off at the rear, and current transformers are placed on the wall side of the incoming leads. One set of buses gives 2300 volts between the neutral wire and each phase wire, corresponding to the company's standard practice in distribution, which permits independent phase regulation and enables transformers with 2300-volt primaries to be used in the lighting service. The other set gives 4000 volts between each pair of busbars.

The high-tension switchboard is 16 ft. long and contains nine panels furnished mainly with Westinghouse apparatus. Three panels are provided for synchronous motors; one panel is for bus junctions, one panel enables either line to be cut off its appropriate bus by an oil switch; one panel controls the supply of energy from the three-phase, four-wire line to the local lighting transformers; one panel enables the fire-pump motor to be operated on either bus; one panel controls the energy supply to the local power transformers, and one controls the supply of energy to a special transformer supplying the laboratory building with power through an induction regulator.

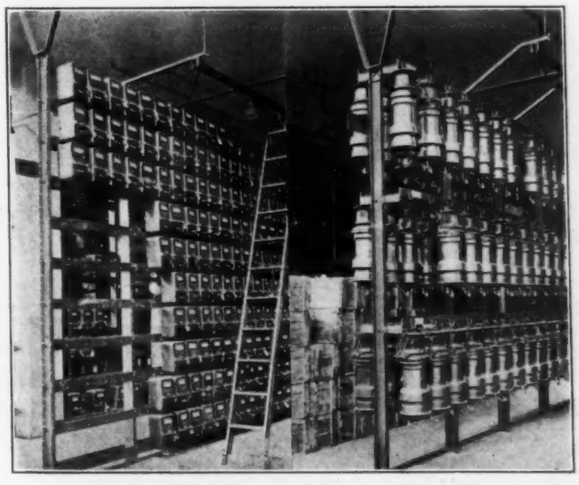


FIG. 9—METER RACK IN STOCKROOM

FIG. 10—MAGNETITE ARC-LAMP STORAGE RACK

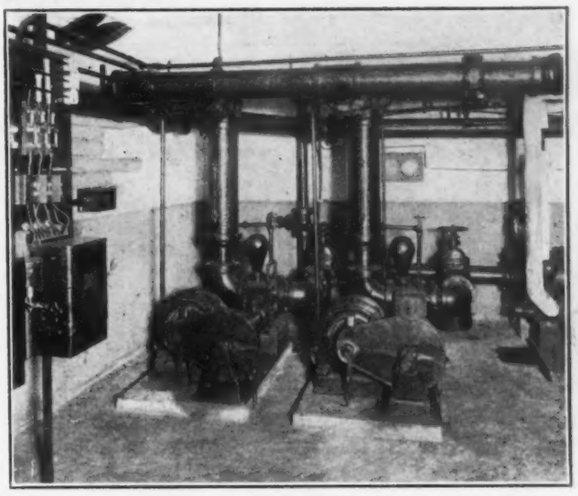


FIG. 11—MOTOR-DRIVEN PUMPS INSTALLED IN SUBSTATION BASEMENT

All the direct current required on the grounds is derived from three synchronous motor-generator sets in the operating room. These machines are of General Electric make, two being equipped with 300-hp, 4000-volt, revolving field motors, each driving two directly connected 100-kw two-wire direct-current interpole generators. The third set consists of a 50-kw two-wire generator directly driven by a 4000-volt, 75-hp motor. All three motors are started through compensator switches on the motor panel, the compensators being mounted at the rear of the switchboard and against the wall. The oil circuit-breakers for the synchronous motor service are arranged with overload relays mounted on the motor-control panels and the board is liberally equipped with testing and instrument calibration contacts. All oil circuit-breakers controlling lines to transformer primaries are numbered to correspond with the transformer numbers and the numbers of the transformer secondary leads running to the low-tension board.

Transformers are housed in a 12.5-ft. by 5.3-ft. fireproof room near the high-tension switchboard. Two 100-kw, three-phase units are provided for the fire-pump service, which is 230 volts, three-phase; a 20-kw transformer provides a special 220-volt, three-phase service for the laboratory; a 100-kw, three-phase transformer takes care of the general 230-volt, three-phase power service around the property; two 100-kw units supply three-wire, 115-230-volt, single-phase lighting service, and a 100-kw transformer is installed for the 115-230-volt regulated power special laboratory service mentioned above. The floor of the transformer room drains out of doors and the doorsill is 1½ in. high to prevent oil overflow. A 10-kw transformer is also installed for the supply of 220-volt, three-phase service to the laboratory.

The low-tension service is controlled from a switchboard in the operating room. This board is 21.5 ft. long and is equipped with eleven panels. The direct-current arrangements consist of a two-wire bus for garage service, a combination high and low bus set with one positive bar and two negative bars for garage use, and a three-wire bus which can be split into two sections to enable energy to be supplied at two different pressures for testing or other work. The generators of either or both large units may be thrown upon either section of the split bus; either may be run

FIG. 12—TYPICAL VIEW, OFFICE OF DEPARTMENT OF MAINTENANCE OF LINES

upon the high or low combination garage buses, and by a tie switch placed on the machine panel the two-wire bus feeding the garage may be thrown upon one section of the split bus.

The 50-kw generator may, if necessary, supply the two-wire bus, caring for daytime battery charging. At night the larger generators are operated on the charging load. The field rheostats of the latter are magnetically operated, their control switches being mounted on the machine panels, while the rheostats are carried on angle-irons above and behind the board. The range of pressure available on these various buses extends from about 70 volts to 300 volts. The alternating-current section of the board contains the usual knife switches governing the various three-wire, single-phase and three-phase motor and lighting circuits, oil circuit-breakers being used on all transformer secondary leads carried to the board. A circuit breaker is installed for each direct-current generator and for each garage feeder; an alternating-current ammeter is provided in each synchronous-motor circuit, and direct-current ammeters are connected in circuit with each generator.

Maintenance Facilities

Building No. 2, utilized as a storehouse for heavy material, is occupied by the street engineering department, street maintenance department and supply department. It has a concrete floor and steel-truss roof and contains ample storage facilities for transformers, cable, reels, underground and overhead material and tools, tubing and spare machinery for company service in substations and elsewhere. In general, this building is the headquarters of the construction and maintenance forces occupied in line work and contains excellent lavatories with unit wash-basins for employees' use, quarters for transformer repairs and testing, and a section utilized by the station engineering force in the storage of tools and supplies.

The transformer-testing facilities are used mainly on apparatus returned from service, and the maintenance work done here consists chiefly of oil removal, fitting of new cases, repairs to terminal blocks and bushings, and the provision of new leads and ground tests. The usual test is 2300 volts between the secondary winding and the core and 6900 volts between primary and core. A special switchboard panel is installed to facilitate transformer testing, giving by 2300-volt steps pressures from 2300 volts to 13,800 volts by the use of plugs and flexible cables connected with the secondary windings of seven small transformers installed behind the board. The transformer primaries are connected in parallel to a 230-volt, three-phase service. A 7-ft. horizontal screen above the panel protects its contacts and circuit-breakers against the chain falls of the traveling cranes which serve the room.

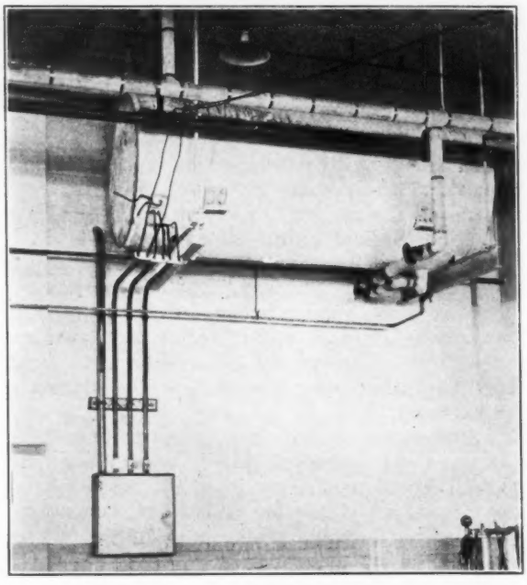


FIG. 15—ELECTRICALLY HEATED HOT-WATER TANK

Tests of linemen's rubber gloves are also made at this point, seamless gloves being tested at 10,000 volts and lined gloves at 6500 volts by partly immersing the glove in salt water, the interior of the glove being filled with shot, so that the potential test is between shot and water.

The building is well provided with doorways for truck service in addition to the spur track and cranes previously mentioned. An interesting detail in the storage facilities is a transformer hanger rack placed against the wall. This rack, measuring 96 ft. long and 7 ft. high, is built of 3-in. by 4-in. timbers and holds about 600 hangers. The rack is constructed in 16-ft. sections, with an intermediate horizontal bar 5 ft. above the floor to care for the longer hanger members. The general lighting is by 250-watt lamps, two being used for truss.

"Welfare Buildings"

The "welfare buildings," as now completed, provide a general meeting place for employees, of whom about 1900 are now on the payroll. There are three

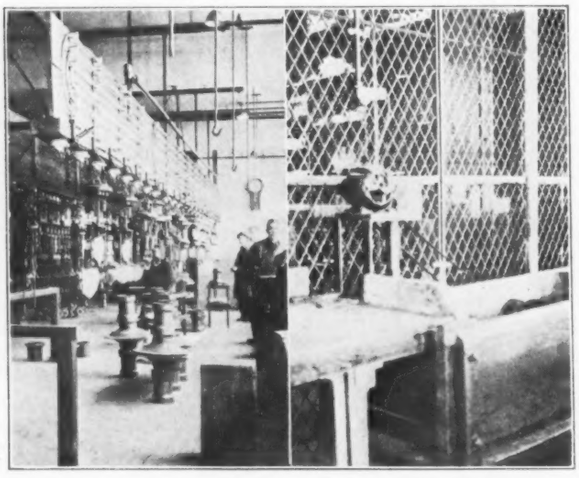


FIG. 13—ARC-LAMP TEST FRAME, ARC-LAMP SHOP

FIG. 14—MOTOR-DRIVEN BRUSH FOR GLOBES

structures in the group and all border an attractive court with broad, connected piazzas. Nothing like these structures has previously been built on a comprehensive scale in the central-station industry. The group consists of a library, a recreation building and a combined auditorium and dining hall. The recreation building is central, the dining hall being on the western side of the court facing the present laboratory. The distance across the open court between the piazzas of the library and dining hall is 225 ft., and in this space three tennis courts will be provided. All the piazzas are covered and brick-paved, being 16 ft. wide and having a total length of 683 ft.

The buildings are all of fireproof construction, with concrete foundations, walls of terra-cotta blocks, and slate roofs. Their equipment provides practically every convenience common to the best clubs. There is a first-class restaurant operated by the company and open twenty-four hours a day every day in the year; private dining rooms are provided for the ladies, and spacious accommodations are offered for entertainments, dances, etc. The building contains four bowling alleys, three pool tables, a billiard table, a number of private lockers and shower baths, large lounging rooms with open fireplaces, a well-appointed library, writing room, committee, card and checker rooms, thirteen sleeping rooms, coat rooms and toilets.

The dining hall will seat 400 people when arranged as a café and 600 when used as an auditorium. A commodious stage and a small gallery for extra seating and moving-picture machines are notable features.

The kitchen, 88 ft. by 17 ft., occupies the entire rear of the building and will be equipped with every feasible and necessary device for electric cooking. Included in this apparatus are a 9-ft. by 3-ft. Simplex flat-topped electric range, three three-heat baking ovens, five hot-food cabinets, one large electric serving table with an electrically heated dish closet, three 5-gal. coffee urns, electrically heated cup warmers, frying kettles, roll warmer, bread raiser, bake ovens of smaller sizes, etc. Outlets are also provided in the dining hall for electric cooking at the tables, and a varied assortment of electric waffle irons, toasters, griddles, egg boilers, etc., is a feature of the establishment.

Yard Lighting

The illumination of the yard and roadways at the service plant is cared for by an initial installation of about twenty 6.6-amp, 350-watt tungsten lamps in ground glass, acorn-shaped globes mounted about 20 ft. above the road surface. Several 400-watt multiple lamps housed in similar globes are mounted on the fronts and sides of the buildings and supplied with energy from the house circuits. The yard lamps are carried by iron goosenecks coated with aluminum paint and mounted on combination wooden and iron poles 19.5 ft. high. The lower sections of these poles are of fluted iron to a height of 3 ft. 6 in. above the ground, with the usual short-circuiting switch in the base. All post lamps are fed by underground conduit. The wooden sections of the poles are 9 in. in diameter at the junction point with the iron bases, and not a trace of a wire can be seen in the entire yard lighting. Constant current for this service is derived from a tub transformer in the operating room of the service buildings substation.

Succeeding sections of this article will describe the arc-lamp shop, methods of testing meters, provisions for handling incandescent lamps, the photometer equipment, and the facilities of the transportation department.

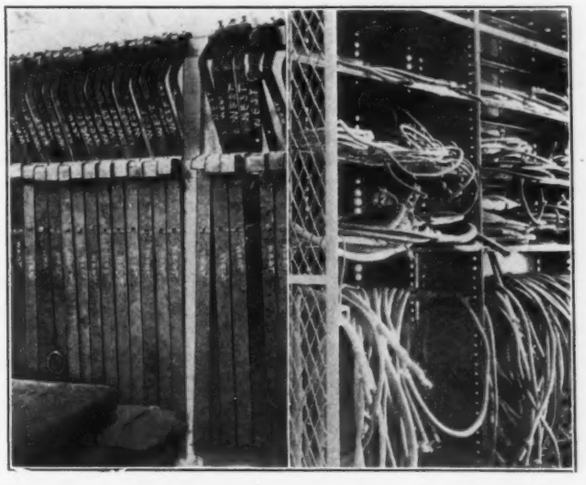


FIG. 16 — TRANSFORMER HANGER IRONS IN RACK

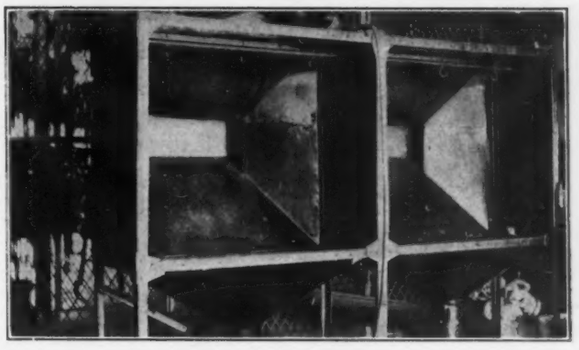


FIG. 17—LOOSE WIRE AND CABLE STORAGE SHELVES

FIG. 18—ARC-LAMP CLEANSING CHAMBERS, ARC-LAMP SHOP

Cost of Electric Hoisting

At the Penn and Republic Iron Mines in Michigan ore is being hoisted in electrically operated cages at 600 ft. per minute with an average energy consumption of about 0.00146 kw-hr. per live-ton-foot. By "live-ton-foot" is meant the weight of the useful material hoisted multiplied by the number of feet of vertical lift. Balanced Curry hoists are employed and the average load per trip is 12,000 lb. As hoisting at these mines is intermittent, the motors are operated on signals only. About twenty seconds is required to bring the hoisting rate up to the normal rope speed of 600 ft. per minute.

Electric Welding While You Wait

A workman in a railway shop approached his foreman not long ago with a request for a new machinist's hammer, showing his former tool split into longitudinal halves as the result of a heavy blow. Being busy, the foreman in a half-joking manner said, "Take it to the electric welder; we're out of hammers." Without question the workman obeyed. Later the foreman noticed the man lustily chipping a nut and asked him where he got the new hammer. The inquiry elicited the fact that the two pieces of the broken hammer, small and irregular as they were, had been welded electrically with neatness almost defying detection. Whether this was an economical process has yet to be determined, but as evidence of the electric welder's general usefulness the incident is worth chronicling.

Model for Alternating-Current Quantities

A kinematical model for displaying the instantaneous relations between the pressure, current, power and energy in an alternating-current circuit. By A. E. Kennelly and H. G. Crane

THE model here described is intended to be operated by rolling it slowly over the edge of a table, so as to be able to observe, from moment to moment, the projections of three revolving vectors upon four graduated scales. Three of these scales, representing respectively volts, amperes and watts, are vertical and are attached to the moving model. The fourth, representing joules, is horizontal and is fastened to the edge of the table.

The model consists of a pair of wooden disks 25 cm in diameter and 1.9 cm thick, mounted rotatively in a brass frame or carriage, which carries a handle at the back. The left-hand disk, which may be called the L disk, takes cognizance of the power and energy relations and rolls counterclockwise on the edge of the table. The right-hand disk, which may be called the R disk, takes cognizance of the pressure and current relations. The R disk is driven counterclockwise by the L disk, at half angular speed, by a small belt, so that R makes one complete revolution for two revolutions of L. Since the model rests upon disk L, and a small roller at the back of R, disk R has no resistance to overcome save the friction of its sleeve on the bearing-pin of the carriage; so there is very little tendency for the driving belt to slip.

Disk R carries one fixed vector painted in white, the full radius of the disk (12.5 cm), and also one adjustably movable vector, carried friction-tight on the shaft of the disk. The fixed or E_m vector represents an impressed emf of 100 volts, while the adjustable brass vector is the current or I_m-vector, the phase of which is adjustable within 60 deg. ahead or astern of E_m. The magnitude of this current may be adjusted by sliding a friction-tight arrow-head along the brass I pointer between the limits of 100 amp and 200 amp. The fixed vertical scale on the carriage in front of the R disk is marked from 0 at the center of the disk to + 20 above and to — 20 below that level. Each unit of the scale represents either 10 volts or 10 amp, so that this R scale reads directly in dekavolts or dekamperes.

Disk L carries a single brass pointer or power vector P, friction-tight on its shaft, so as to be adjustable in phase. An arrow-head, friction-tight on the pointer, allows the vector power to be set at different vector lengths. A thin brass strip hangs vertically from the arrow-head so as to mark the projection of the latter on the horizontal scale of joules fastened to the table edge. The fixed vertical scale, carried in front of the L disk, is graduated from 0 at the table level to + 15 kw above and — 5 kw below.

When the model is allowed to roll toward the left along the table edge, starting from a point when the E vector painted on the R disk is vertical and upward, while the I vector on the R disk has its proper phase with respect to the latter, and the P vector stands parallel to I, the vectors continue to rotate in such a manner that their projections on the proper scales mark the instantaneous values of E, I, P and W in dekavolts, dekamperes, kilowatts and kilojoules respectively.

Figs. 1 to 5 inclusive show five successive stages in a cycle of cophase E and I, with power-factor 1. Figs. 6 to 11 inclusive show six successive stages in a half-cycle, with I lagging 60 deg. behind E and with power-factor 0.5.

Considering the non-inductive case of Figs. 1 to 5, we have a maximum cyclic emf of $100 \angle 0°$ volts, supplying a maximum cyclic current of $100 \angle 0°$ amp through a resistance of 1 ohm. In Fig. 1 the E and I vectors are shown at 10, just behind the vertical position of standard phase, while P is shown at 10 in the same phase. The vertical index from P is over the zero of the energy scale.

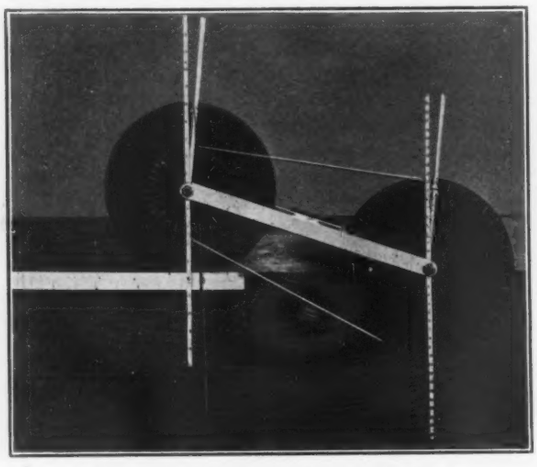


FIG. 1—NON-INDUCTIVE CASE

$E = 100 \angle 0°$ volts $P = 10 \angle 0°$ kw

$I = 100 \angle 0°$ amp $W = 0$ kj

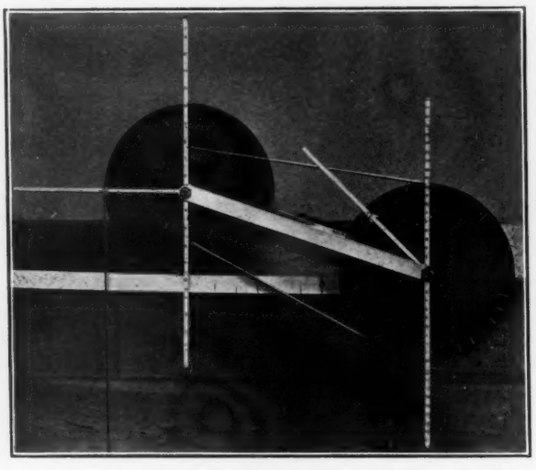


FIG. 2—NON-INDUCTIVE CASE

$E = 100 \angle 45°$ $W = 1.0$ kj

$I = 100 \angle 45°$ $e = 70.7$ volts

$P = 5.0$ kw $i = 707$ amp

In Fig. 2 the E and I vectors have advanced through 45 deg., while the P vector has advanced through 90 deg. The instantaneous projection of E is 7.07 dekavolts, of I 7.07 dekamperes, of P 5.0 kw. It is assumed that the emf makes 1 cycle per second, so that there will be 5 kilojoules of energy delivered to the circuit per second. In the first eighth of a second, as represented in Fig. 2, the average energy would be 0.625 kilojoule, but the actual energy expended is 1 kilojoule.

In Fig. 3, one-quarter of a second from the start, E and I have advanced a quarter cycle, or 90 deg. Their instantaneous projections are zero. P has advanced through one-half of its cycle, or 180 deg.; its projection has vanished. W has advanced to 1.25 kilojoules. At this instant the energy liberated in the circuit is momentarily stationary. That is to say, there is a momentary stoppage in the energy flow.

In Fig. 4, one-half second from the start, E and I have completed a half-cycle, while P has completed a cycle or one revolution of the L disk. The instantaneous emf and current are each at — 100, and P is at 10. The instantaneous energy is at 2.5 kilojoules.

Finally, in Fig. 5, three-quarters of a second from the start, E and I have their projections at zero, and P is also at zero with a total energy output at 3.75 kilojoules, with another momentary energy pause.

The three vectors E, I and P thus rotate together, except that P has double frequency. The energy pro-

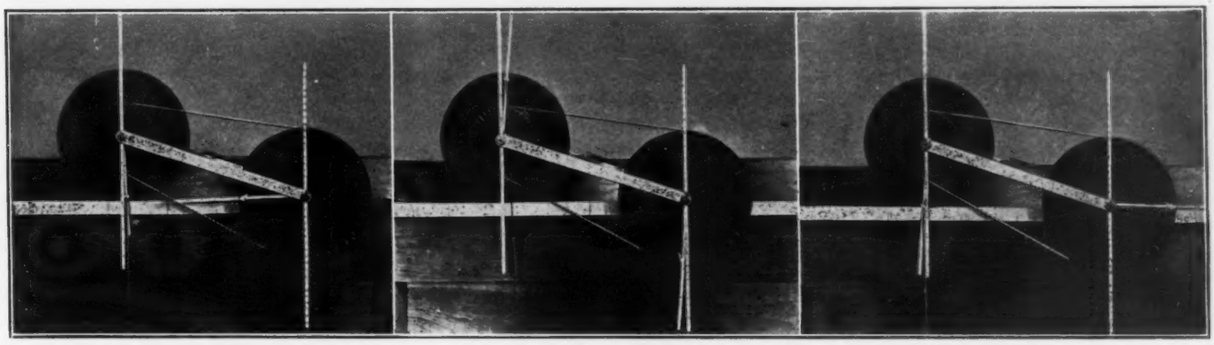


FIG. 3—NON-INDUCTIVE CASE

$E = 100 \angle 90°$ $W = 1.25$ kj
$I = 100 \angle 90°$ $e = 0$ volts
$P = 0$ kw $i = 0$ amp

FIG. 4—NON-INDUCTIVE CASE

$E = 100 \angle 180°$ $W = 2.5$ kj
$I = 100 \angle 180°$ $e = 100$ volts
$P = 10.0$ kw $i = 100$ amp

FIG. 5—NON-INDUCTIVE CASE

$E = 100 \angle 270°$ $W = 3.75$ kj
$I = 100 \angle 270°$ $e = 0$ volts
$P = 0$ kw $i = 0$ amp

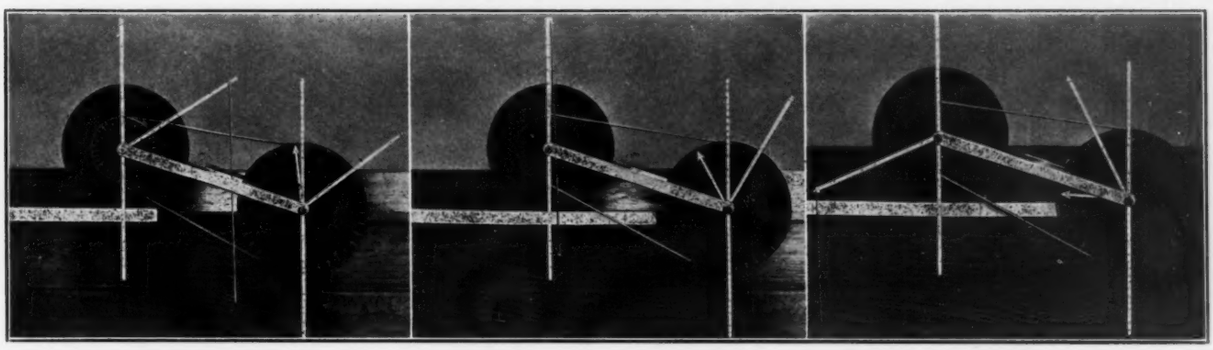


FIG. 6—INDUCTIVE CASE

$E = 100 \angle 0°$ $W = 0.69$ kj
$I = 200 \angle 60°$ $e = 100$ volts
$P = 10.0$ kw $i = 100$ amp

FIG. 7—INDUCTIVE CASE

$E = 100 \angle 30°$ $W = 0.42$ kj
$I = 200 \angle 30°$ $e = 86.6$ volts
$P = 15.0$ kw $i = 173.2$ amp

FIG. 8—INDUCTIVE CASE

$E = 100 \angle 90°$ $W = 1.94$ kj
$I = 200 \angle 30°$ $e = 0$ volts
$P = 0$ kw $i = 173.2$ amp

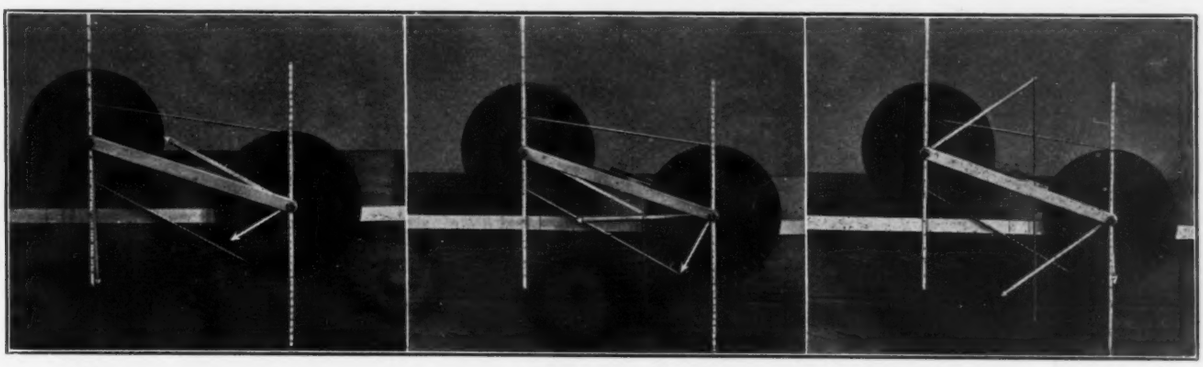


FIG. 9—INDUCTIVE CASE

$E = 100 \angle 120°$ $W = 1.67$ kj
$I = 200 \angle 60°$ $e = 50$ volts
$P = 5.0$ kw $i = 100$ amp

FIG. 10—INDUCTIVE CASE

$E = 100 \angle 150°$ $W = 1.39$ kj
$I = 200 \angle 90°$ $e = 86.6$ volts
$P = 0$ kw $i = 0$ amp

FIG. 11—INDUCTIVE CASE

$E = 100 \angle 180°$ $W = 1.81$ kj
$I = 200 \angle 120°$ $e = -100$ volts
$P = 10$ kw $i = -100$ amp

jection is that of a point on the tread of a rolling disk, and is thus the projection of a cycloidally moving point.

Turning now to the inductive case, Fig. 6 represents a maximum cyclic impressed emf of 100 volts acting on a maximum cyclic current of 200 amp retarded 60 deg. in phase. At the moment presented the emf is at standard phase, or full maximum, corresponding to $t = 0$ in the equation $e = 100 \cos (\omega t)$ volts, it being understood that the frequency is to be one cycle per second, and therefore the angular velocity ω of the vector is 6.28 radians per second. The emf in Fig. 6 has in fact passed its maximum a few degrees, and sufficiently far to reveal the painted arrow clear of the vertical scale on the R disk. The I pointer with its arrow-head at the extreme end follows E 60 deg. in the rear. The active component of this current is 200 cos 60 deg. = 100 maximum amp, or the same as in the non-inductive case, but the reactive component is 200 sin 60 deg. = 173.2 maximum amp. On the L disk the power vector starts at 10 kw amplitude, parallel to I; that is, 60 deg. behind the maximum projection. At the instant represented the power is just 10 kw and the vertical projection from the P arrow-head would intersect the horizontal white energy scale at — 0.69, the axis of P being over the zero of this scale.

In Fig. 7, after the lapse of one-twelfth second, E has advanced 30 deg., I being 30 deg. behind its maximum. P has reached its maximum development at 15 kw, and W has reached 0.42 kilojoule, or 1.11 kilojoules beyond its starting point.

Fig. 8 shows the state of affairs after the lapse of a quarter emf cycle. The projection of the E vector is now zero, and that of I is 173.2 amp. The projection of the P vector is zero, and on the W scale 1.94 kilojoules. This energy projection, instead of advancing, now commences to retreat, representing a floodtide of energy from the circuit back to the source during this portion of the cycle.

In Fig. 9, after one-third of an emf cycle, the E vector has advanced through 120 deg., and its projected value is — 50 volts. The I vector has its projection at + 100 amp. The power-vector is at — 5 kw, and the energy has receded to 1.67 kilojoules.

In Fig. 10, five-twelfths of an emf cycle from the start, the E vector, having advanced through 150 deg., has a projected value of — 86.6 volts, while the projected value of the current is zero. The projected value of the P vector on the vertical power scale is 0 kw, and on the horizontal energy scale is 1.39 kilojoules. From this moment the floodtide of energy stops and the ebbtide commences, at first slowly, and then at maximum rate when the power is a maximum.

Finally, in Fig. 11, after a lapse of one-half emf cycle, the emf has just passed its full negative value, while the current is — 100 amp. The exact epoch designated would leave the E pointer concealed. The projection of the P pointer on the vertical scale of disk L is 10 kw, and that on the horizontal scale 1.81 (1.84 actually indicated owing to the necessary displacement for revealing E). The actual energy delivery in the emf half cycle has therefore amounted to 2.50 kilojoules. It is evident that the conditions in the next emf half cycle will be the same as in that just considered, except that the signs of E and I are both opposite to what they were.

The paths of the E, I and P vectors with relation to their traveling vertical scales are simple circles. The path of the P vector with respect to the fixed horizontal scale of energy is an oblate trochoid.

We have hitherto assumed that the emf phase was the phase of reference for E and I vectors, so that the current was taken as lagging with respect thereto. We may, however, take the current phase as the phase of reference, and the emf leading with respect thereto. This means starting the model with I vertical, and P at the same moment parallel to the leader E.

We have also assumed that the circuit represented by the model was inductive, or that the current lagged behind the pressure. But in order to represent a condensive circuit, with the same power-factor, to pressure standard phase, it is only necessary to start with E vertical, I advanced 60 deg., and P at the same moment parallel to I.

The model described is constructed for an active power of 5 kw, as it would be indicated on an ordinary wattmeter in the circuit. That is, with E_m at 100 volts, the inphase or active component of I_m must be 100 amp. The actual maximum cyclic current may vary between 100 amp and 200 amp, with a corresponding phase difference from 0 deg. to $\pm$ 60 deg. It would readily be possible to make the model capable of representing lesser active powers and power-factors by changing the size of the rolling disk L. For zero power-factor the rolling disk diameter should be zero, so that the disks should then rotate without perceptible advance. Since, however, the purpose of the model is to reveal to the eye the essential relations between the E, I, P and W cyclic variations in a simple alternating-current circuit, it is not necessary to indicate more than a few illustrative cases.

In the operation of the model, E, I and P advance with time counterclockwise, or according to convention, and their instantaneous projections on their appropriate vertical scales travel up and down in the conventionally correct + and — directions, except as regards the direction of advance over the energy scale, which is from right to left, or negative. This error in direction may, however, be conceived to be eliminated by making the model roll vertically upward on the edge of a door. The advance over the W scale would then be positive upward, and the E I P scales would become horizontal scales, retaining their proper conventions.

The theory of the action of the model was discussed, without reference to a working model, in a paper* presented by one of the authors of this article before the annual convention of the American Institute of Electrical Engineers held in 1910.

Mercury-Vapor Light for Inspecting Translucent Products

Cube sugar and ivory piano keys are inspected under artificial illumination produced by mercury-vapor lamps with greater speed and accuracy than can be attained in ordinary daylight. Raw sugar is a brown substance, while the refined product is pure white, its whiteness being due to the same cause as the whiteness of snow, since both are made up of small transparent crystals. Any impurity in sugar manifests itself by changing the white to a shade of yellow. To detect impurities, plates of the crystallized sugar 1 in. thick are examined by a man looking through them toward a mercury-vapor lamp. When thus viewed the yellow impurities stand out clearly in the bluish-green light. The color of ivory varies from the outside to the center of the tusk to such an extent that manufacturers sort the pieces into sixteen different shades. Formerly this sorting could be done only in bright daylight, but with the light of the mercury-vapor lamp grading can be done without limitation at any hour out of the entire twenty-four.

---

*"Vector Power in Alternating-Current Circuits," by A. E. Kennelly, *Trans.* Am. Inst. Elec. Engrs., June, 1910, Vol. XXIX, Part II, pp. 1233-1267.

Canadian Electrical Association Convention at Montreal

Abstracts of papers and discussions presented at the twenty-fourth annual meeting of electrical utility operators of the Dominion, June 24, 25 and 26

A SUMMARY of the news features of the Montreal convention of the Canadian Electrical Association, June 24, 25 and 26, was given in these columns last week. Herewith we present abstracts of papers and discussions withheld for lack of space in that issue. In addition to the formal papers here noted, addresses were also delivered by Mr. L. B. Chubbuck, Hamilton, Ont., on "Modern Switching Equipment"; Mr. J. F. H. Wyse, Toronto, Ont., on "Safety First," and Mr. H. J. Madgsick, Cleveland, Ohio, on "High-Efficiency Incandescent Lamps."

Legal Aspects of Electrical Interference

"The Legal Aspect of Interference Between Systems of Electrical Companies" was the subject of a paper by Mr. G. H. Montgomery, K. C., Montreal, read at the session of Wednesday afternoon. Mr. Montgomery reviewed in a general way the tenor of the judgments handed down in the United States in such cases, bringing out the general point that priority usually indicates superior rights, although this suffers exception due to franchise rights. Street railways enjoy dominant rights within city limits but are considered a burden on country roads. Priority usually holds in cases of interference in overhead lines, but disturbance in telephone and telegraph lines cannot be claimed if the companies are not equipped with modern appliances for correcting this trouble. In the Canadian decisions cited it was pointed out that travel is the dominant purpose of the streets; that telephones and telegraph lines can be placed on the sides but must not interfere with each other or with the power lines, and that priority usually holds within reasonable rights. In closing, Mr. Montgomery suggested further investigation of the topics of decisions relating to electrolysis and accident cases.

Discussion

Mr. D. H. McDougall, of Toronto, cited the verdict recently handed down in favor of the Toronto Electric Light Company in a case where the city contended that all of the poles of the company were used to light the streets and therefore should be removed in accordance with a clause in the street-lighting agreement by which all poles should be removed on the expiration of the agreement.

Mr. A. A. Dion cited a case in Ottawa where, taking advantage of a clause in the franchise which allowed the municipality to attach wires to the company's poles (fire alarms being the intention of the clause), the municipality insisted that this meant any wires and that it could transfer this right to another company which had started up in competition. Arbitration upheld the municipality on this point and the city later bought out the competing company and now has the use of the company's poles. The arbitration made this a mutual privilege accompanied by a nominal yearly rental fee.

Grounding of Distribution Circuits

The undesirability of operating grounded distribution systems unless the ground connections have very low resistance was brought out in Mr. S. Bingham Hood's paper on "Grounding of Distribution Circuits." Attention was called to the fact that driven grounds vary in resistance from about 5 ohms to 180 ohms, depending on the soil and contact therewith. In the earth around

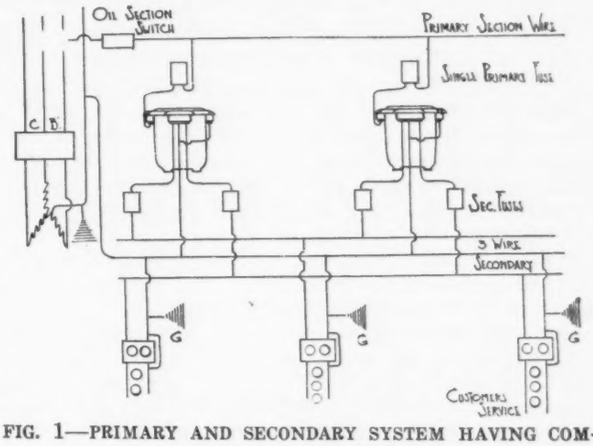


FIG. 1—PRIMARY AND SECONDARY SYSTEM HAVING COMMON GROUNDED NEUTRAL

such ground connections the potential gradient may be considerable, and a person walking in the vicinity may receive a noticeable or even fatal shock due to the potential difference between the places where his feet touch. The danger of having uninsulated ground wires on poles was also pointed out when they are in such positions that linemen may come in contact with them while working on ungrounded conductors. The method illustrated here was suggested for grounding house-service systems and is less expensive than that prescribed by the code. Where possible it was advised to connect ground conductors to water pipes at the point where they leave

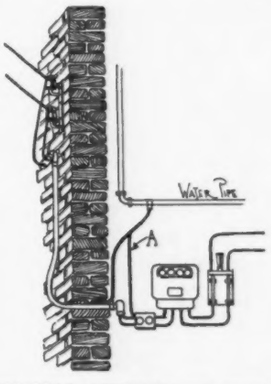


FIG. 2—ECONOMICAL METHOD OF GROUNDING HOUSE CIRCUITS

the building. When lines enter a house through the upper walls it is sometimes practicable to attach the ground wire to bathroom fixtures or vent pipes, or to overflow pipes on expansion tanks when hot-water heating equipment is employed. By thoroughly ground-

ing the neutral conductor of an interconnected three-wire distribution system every 300 ft. or 400 ft. it was declared that accidents and instrument trouble from accidental grounds have been considerably decreased. A three-phase primary and a three-wire secondary system were described having a common neutral conductor which makes it possible to eliminate ground wires on poles and employ one conductor in the single-phase primary sections, thereby reducing the installation investment. The connections used in this system are shown in an accompanying diagram.

Discussion

Mr. V. B. Coleman, of Port Hope, said that his city has no extensive water-works system, and while one part of the town is underlaid by rock very close to the surface, the other portion is built on a deep layer of porous sand.

Mr. Wills Maclachlan, Toronto, said that in towns built on sand he had found "coke" grounds to be the most satisfactory, although they have to be inspected from time to time. He took issue with Mr. Hood on the point of removing ground wires from transformer poles and insisted that to insure grounding of the system transformers ground wires should be run down transformer poles and insulated if necessary to protect the linemen.

After further discussion by Messrs. Dion, Mudge and Gould, a resolution was passed that a committee on grounding be appointed with Mr. S. B. Hood as chairman. It was suggested that the committee (1) obtain a complete record of present rules and regulations on grounding, (2) obtain full information from member companies as to their experience in different localities, (3) secure information from the N. E. L. A. and from European societies on the question of grounding, (4) draft recommendations for standard practice of grounding, (5) carry on a campaign of standardization of grounding among member companies, and (6) assist in demonstrating to municipalities that grounding to water systems is not injurious.

Value of Electric-Heating Load to Central Stations

Electric heating devices, operating data thereon and the revenue produced by such loads were discussed in Mr. Harold S. Brown's paper on "The Value of Electrical Heating Devices to the Central Station." Electric flatirons were referred to as being the most extensive revenue producers of all heating devices. The average monthly income from them comes to about 70 cents each, and since about 250,000 irons were sold in 1910, the estimated revenue therefrom ($2,000,000) about equaled the value of the apparatus sold. Investigations conducted in 1911 at Scranton, Pa., showed that the flatiron load is very desirable, for on the days when most used the load comes on at 7 a. m. and disappears about 5 p. m. Data were presented on the cost of operating electric ranges in preparing meals for average and large-sized families, for hotels and clubs, etc. For a family of four or five people meals were prepared for a total monthly cost of $3 at an energy rate of 3 cents per kw-hr. The maximum demand during the six successive days' tests was 2.85 kw, and the average energy consumption was 3.28 kw-hr. By employing six ranges and preparing all of the meals at once (a theoretical case) the maximum demand would have been only 9.6 kw instead of 17.1 kw, thus showing a diversity factor of 56 per cent. The costs of cooking similar foods by gas and electricity were also compared with electricity at 3 cents per kw-hr. and gas at $1 per 1000 cu. ft. In some cases the costs were about the same, in others the gas or electricity showed advantages. When meals were prepared by electricity the average energy consumption was 0.219 kw-hr. per person for average meals and 0.369 kw-hr. for heavy meals. With energy at 3 cents per kw-hr. the cost of preparing a meal for five persons varied from $0.007 to $0.019 per person. The revenue derived from electric cooking is as high as fifteen times that derived from lighting in some localities. A club employing an electric range and bake-oven with steam-heated stock kettles reported that electricity at 3 cents per kw-hr. will compete with coal at $7.50 per ton or gas at $1 per 1000 cu. ft.

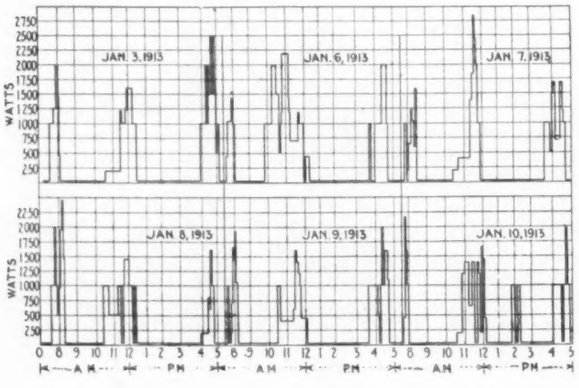


FIG. 3—POWER DEMANDS FOR PREPARING MEALS FOR FIVE PERSONS

Discussion

Mr. Brown's paper was preceded by a moving-picture film depicting the advantages of electrical appliances in the home.

During the discussion of the paper Mr. Leacock, of Toronto, and Mr. Moore, of Belleville, brought out the point that the shrinkage in roasts cooked by electrical heat is only 8 per cent as compared with 20 per cent by gas or coal.

Mr. D. H. McDougall, of Toronto, and Mr. A. A. Dion, of Ottawa, warned that the universal use of electric ranges and appliances might bring about a "heating peak" higher than the normal lighting peak, and this by means of business obtained on a supposedly "off-peak" rate!

Mr. W. L. Bird, of Fort William; Mr. J. C. Wills, of Belleville, and Mr. Wills Maclachlan, of Toronto, showed that electric ranges would be used more in summer than in winter and that residential business is of value to a central station not only from the purely financial standpoint but also by reason of the political aid obtainable from satisfied householders.

Mr. G. Radcliffe-Hulme, representing the British Electric Traction Systems, advised the proper installation of all electric appliance outlets and wiring.

Co-operation in Appliance Sales

"Co-operation in the Selling of Heating and Cooking Devices from the Standpoint of the Central-Station Companies" was the topic of a paper by Mr. W. B. Johnson, Montreal, in which the author declared that the selling of electrical appliances by central stations has no defense from a commercial standpoint but simply antagonizes the contractors and dealers. Prices should be maintained at which the dealer can make his fair profit, and this should be from 20 per cent to 30 per cent above cost. Sales of appliances should not, however, be left entirely to dealers, as such sales are always boosted by the central station carrying them. Cutting of prices by dealers is the only justification for reducing the standard price on the part of the cen-

tral station. Appliances at cost or reduced prices will sell quickly but are also discarded quickly.

Discussion

A lively discussion followed the reading of the paper. Mr. V. B. Coleman, of Port Hope, and Mr. R. J. Smith, of Belleville, both declared that the dealers in small towns have no special interest in appliances, do not inform themselves on the question and, if they were to push the sales, they would be likely to encourage inefficient apparatus.

Mr. Oswald H. Scott, of Belleville, on the other hand, felt that the public would soon find who supplied the most efficient appliances and that the dealers alone should handle them.

Messrs. Maclachlan and Dion in speaking of the sale of lamps felt that 25-watt and 40-watt lamps should be sold at the same price but that the 60-watt size is rather too large for residence use and therefore should be rated at a different figure. Mr. Dion in particular stated that the equal pricing of 25-watt and 40-watt lamps had resulted in a greater energy consumption than would have obtained if the prices had been higher on the 40-watt unit.

Mr. Carr, of Toronto, asked why central stations do not give away electric irons if the revenue therefrom is 70 cents per month. Mr. Johnson replied that 70 cents per month is too much to be expected from an iron and that the policy of giving away any appliance is not a sound one.

Maximum Demand

Mr. P. T. Davies, of the Montreal Light, Heat & Power Company, presented a paper on "Maximum Demand Determination and Its Relation to the Cost of Supply of Electrical Energy." The author showed that the most important item in the cost of supplying energy is that of fixed charges. For a steam plant with a high load-factor the fixed charges may average 78.5 per cent of the total charges, while for a hydroelectric development they may amount to 86 per cent. The amount of the fixed charges borne by the customer depends on his demand. This may be determined on the basis of instantaneous peak, of lowest point of usage during a stated interval, or of average load during a known interval. The first two were shown to be unsatisfactory. Taking the third method, the author discussed the length of demand period, the number of demands to be taken, and whether a demand once established shall remain the billing basis for the remainder of the contract, unless exceeded.

Discussion

Mr. McDougall, in view of the investment required for supplying service, advocated a progressive demand, that is, that the demand once established should obtain throughout a year rather than fluctuate each month.

Another point of view was offered by Mr. G. Radcliffe-Hulme. His opinion, based on eighteen years of central-station experience in England, was that the maximum-demand basis of billing is not the most satisfactory method. In the event that a demand basis were to be used he advised against taking any standard duration of peak but suggested measuring the overlapping of the motor and lighting peaks as a method of arriving at the demand for billing purposes.

Steam Railway Electrification

Mr. J. A. Shaw, of the Canadian Pacific Railway Company, presented some notes on steam-railway electrification. Of the three systems—three-phase, single-phase and 2400-volt direct current—only the last two, he declared, are shown to be suitable for general work. The author compared the general arrangement of the two systems and their cost of installation and operation. Where energy is obtained from a three-phase distribution, the single-phase and direct-current costs are substantially the same. The single-phase current has an objectionable effect on telegraph and telephone wires, while with direct current there is the objectionable feature of electrolysis. The 2400-volt direct-current system presents a few difficulties, but these will be remedied by experience. The author then made a final comparison of the two systems. With direct current a large portion of the installation cost is in feeder copper and conversion apparatus, and less in locomotives. Most of the operation costs are in substation attendance and maintenance, instead of in locomotive maintenance as in a single-phase system. The regulation of speed on the single-phase system is in many ways preferable to that on the direct-current system. It has been estimated that on a 440-mile division electric operation offers a saving of 25 per cent over steam.

Interruptions on Long-Distance Transmission Lines

In his paper, "Interruptions on Long-Distance Transmission Lines; Their Origin and Means of Prevention," Mr. P. Ackerman pointed out that from 80 per cent to 90 per cent of transmission-line interruptions are caused by lightning puncturing insulators or causing flash-overs. By designing insulators so that surges with steep wave-fronts will flash over rather than puncture the insulators, one of the principal causes of breakdown can be eliminated. When an insulator is punctured the energy discharged is usually concentrated in such a small space that it will sometimes burst the disks and even unseat or burn off the conductors. It is therefore advisable to support the conductor away from the insulator if possible. As a flash-over serves as a sort of safety valve to insulators, it is advisable to make the ratio of puncture voltage to flash-over voltage about 1.5:1, or, better, 2:1. When requiring tests on insulators to insure electrostatically even and sound material it should be specified that a flash-over test of several minutes' duration be conducted with the short-circuit current of the testing transformer choked down as much as possible. Attention was called to some flash-over tests which showed that insulators built with sections similar to suspension-insulator disks are damaged less by flash-overs than are insulators having drooping petticoats with deep air pockets. Discharge horns were recommended to protect insulators from the brunt of flash-overs, but Nicholson arc extinguishers were suggested as a better preventive of insulator trouble. Interruptions caused by sleet or wind short-circuiting conductors can be prevented most effectively by selective relays. Selective straight-overload protection employing definite-time relays was recommended for localizing interruptions in distribution or feeders. It was suggested that the selective action of reverse-energy relays can be improved where conditions permit operation of two lines with the high-tension side sectionalized, thus affording a path for a short-circuit current from one line into the other through the transformers and low-tension bus. This arrangement will have a tendency to maintain some voltage on the low-tension bus and thereby insure operation of the reverse-energy relays. Selective protection of three or more parallel lines can be obtained by taking advantage of the fact that a short-circuit in one line unbalances conditions in the respective phases of the other lines.

Messrs. Maclachlan and Hood, of Toronto, brought up the question of "fatigue of insulators," and the author of the paper expressed as his personal opinion that this fatigue is a molecular phenomenon similar to that of a steel spring under vibration.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Cost of Handling an Electric-Light Bill in Chicago

The average cost to the Commonwealth Edison Company, Chicago, for handling a customer's bill is said to be 12 cents. In this figure are included cost of material and labor required to complete the operation of rendering the bill. Collections are made in the regular way, and it is interesting to note that 72 per cent of the customers' bills are paid by mail and through the various cashiers' offices, 23 per cent are received through collectors, while the remaining 5 per cent reach the company through the medium of an express company, the customer paying a small fee for the convenience of paying in his own neighborhood. The scheme now in force of carrying lamp-renewal accounts in connection with the customers' bills is said to facilitate collections for lamp renewals and to save considerable money which would otherwise be expended in extra stamps for mailing lamp-renewal bills.

Electric Vehicle in Outdoor Vacuum-Cleaner Demonstration

By employing an electric vehicle in a new business campaign conducted recently by the United Electric Light & Power Company, New York, it was possible to

OUTDOOR DEMONSTRATION OF VACUUM CLEANER ON ELECTRIC VEHICLE

demonstrate the operation of an electric vacuum cleaner on the street, thereby attracting considerably more attention than could have been obtained by an office-window demonstration. The campaign not only advertised the particular electric appliance being introduced but suggested to others how an electric vehicle can be utilized in demonstrating apparatus which requires electricity for its operation. Energy from the vehicle storage battery was utilized in operating the cleaner and in illuminating signs advertising the electric-service company and the special price of the appliance displayed.

To provide for the street demonstration, a 1-ton truck which had been in service for several years was stripped of its body and a carpeted platform fastened to the chassis in its place. Wooden uprights connected by a railing and braced by two-by-fours were then erected on the platform to support a 24-in. transparent border sign. The framework, while preventing the demonstrator within from accidentally stepping off the platform, permitted a clear view of the operation of the vacuum cleaner. The lettering on the border sign was brought out emphatically by illumination from 90-volt lamps equipped with Frink reflectors concealed within the box-shaped sign. Long horizontal panels below the border sign were equipped with Argus lamp-letters spelling out the name of the electric-service company.

The demonstration on the vehicle was supplemented by the circulation of pamphlets advertising the reduced price at which the cleaner was offered for sale. During the campaign, which covered May and June, forty-dollar vacuum cleaners were sold at $27.50. Return postal cards attached to the circulars, when signed by a prospective customer, instructed the company to send a demonstrator to the inquirer's home. The text on the folders called attention to the construction of the cleaner and also to the low cost of operation—1 cent per hour.

Impressed by an increase in sales of over fifteen cleaners per week (due to the display), the company has decided to utilize this effective publicity method still further in a flatiron campaign.

Reserves for Depreciation

Mr. H. A. Fee outlined in a paper before the Michigan Electric Association the necessity for making proper reserves for depreciation. Too often companies view with satisfaction a growing surplus, although such surplus would be much less had depreciation been taken into account. Rates have been reduced where earnings were high, although this would not have happened under a proper system of accounting. Ordinary maintenance takes into account only partial renewal. Cumulative depreciation, on the other hand, considers wear or decay, inadequacy, obsolescence, disaster, and loss of franchise. In arriving at the proper percentage care must be taken to treat each plant separately. The author stated that the simplest method of creating the reserve is to combine the straight-line method with the sinking-fund method, so that the straight-line funds in accumulating may yield the greatest possible earnings. The creation and maintenance of a reserve fund should always precede the payment of dividends. At the end of his paper the author appended a form of cash and journal account and a ledger account for handling depreciation.

Seven Barrels of Self-Heated Irons

Mr. C. E. Michel, manager of the appliance department of the Union Electric Light & Power Company, St. Louis, Mo., recently announced that the company would allow its customers $1 on the purchase price of any electric iron if they brought with them any type of old self-heated iron when they called to make their electrical purchases. As the result of this offer and the ensuing campaign, seven barrels of old irons now stand in the cellar of the St. Louis company's electric store. Eighty per cent of the lot are gas-heated irons and the remainder are charcoal and gasoline irons. Mr. Michel says that these old relics will soon be dumped from the Eads Bridge into the Mississippi River.

Application of Twenty-Five-Cycle Motors to Machine-Tool Drive

The bringing of Keokuk hydroelectric energy into a manufacturing center such as St. Louis has created some interesting problems for the engineer. The Manufacturers' Railway Company, as its name implies, handles freight for manufacturers in the southern part of the city. For repairing its steam locomotives

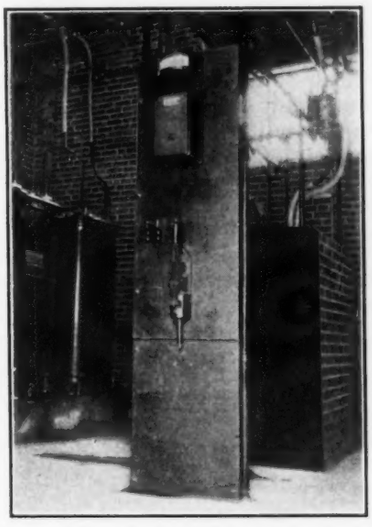
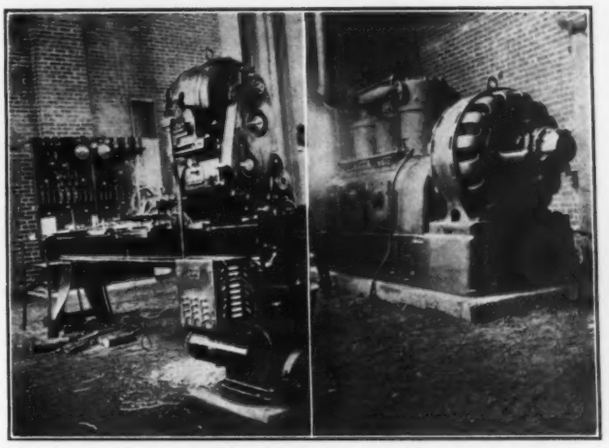


FIG. 1—INTERIOR OF PRIVATE SUBSTATION

a new shop has been erected along the company's right-of-way which at this point parallels the Mississippi River. Repair work on steam engines of construction companies and other interests not having repair shops of their own is also taken to keep the shop working at high efficiency.

Energy from the mains of the Union Electric Light & Power Company is delivered to a brick substation outside the shop where the potential is reduced from 13,200 volts to 230 volts. In addition to the three 350-kw transformers, the substation contains the usual oil-switching, metering, lightning-arrester and choke-coil equipment. Energy for the entire shop is metered on the watt-hour meter shown on the panel in the substation (Fig. 1). An average of the meter readings made since the shop has been in operation shows that the monthly energy consumption for all motors and lighting is approximately 12,000 kw-hr.

Separate circuits in the shop are controlled from the two-panel distribution board shown in Fig. 2. Here also is shown one of the variable-speed lathes driven by an individual motor mounted above the headstock.



FIGS. 2 AND 3—ALTERNATING-CURRENT MOTOR APPLICATIONS

When Mr. C. F. McGregory, who is in charge of the shop, had the purchase of this machinery under advisement considerable doubt was expressed as to the feasibility of alternating-current motors for the work. However, with the speed changes obtainable from the motor itself, used in conjunction with the lathe back

MOTOR APPLICATIONS IN MACHINE AND CARPENTER SHOPS

Number of Motors	Aggregate Hp	Application
Machine shop:		
3	24	79-in. driving-wheel lathe
1	5	5-ft. radial drill.
1	1	22-in. drill press.
1	5	12.5-in. double-head bolt cutter.
1	5	24-in. shaper.
1	10	24-in. engine lathe.
1	3	14-in. steel lathe.
1	15	42-in. boring mill.
1	3	Double-wheel emery grinder.
1	15	36-in. by 36-in. by 14-in. planer.
1	1	50-ton forcing press.
2	70	Transfer table for locomotives.
1	60	Three-cylinder air compressor.
1	5	Metal saw.
1	2	Drill grinder.
1	27	Locomotive jacks.
3	25	10-ton Pawling & Harnischfeger crane.
1	25	10-ft. fan.
1	20	Centrifugal pump.
1	0.5	Metal-saw grinder.
Carpenter shop:		
1	5	Variety saw.
1	5	Carpenter's planer and joiner.
1	5	Band saw.
1	3	Pattern-maker's lathe.
29	339.5	

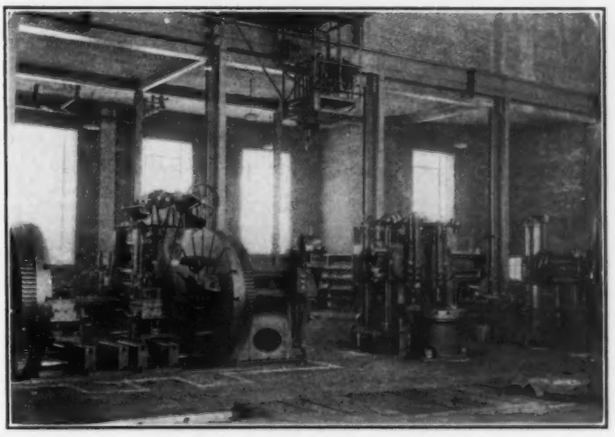


FIG. 4—GENERAL VIEW OF SHOP

gears, it is possible to secure eight speeds. These are of such wide range that any piece of work ordinarily accomplished by the lathe equipped with a direct-current variable-speed motor may be turned out with equal ease and accuracy with this equipment.

Another interesting motor-driven machine is the automatic air compressor shown in Fig. 3, which supplies air for drills and hammers in the shop. This three-cylinder machine, driven by a 60-hp motor, delivers 300 cu. ft. of air a minute to the supply tank and its operation is controlled by a pressure valve manipulating the control apparatus whenever the pressure in the tank falls below a predetermined limit.

A general view of the shop, including the Niles-Bement 79-in. driving-wheel lathe, is given in Fig. 4. Driven by three motors aggregating 24 hp and provided with a double-quartering attachment, this machine has proved to be efficient for finishing large pieces presenting themselves to the shop force.

The accompanying table gives a complete list of the motor applications. All machines are of the alternating-current, three-phase, twenty-five-cycle type and were furnished by the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Wagner Electric Manufacturing Company. A portion of the shop is in operation throughout the entire day furnishing a twenty-four-hour load for the electric-service company.

House-Wiring Results from Plan of Prize Awards

By giving each month prizes of an amount less than the salary of one salesman working on the house-wiring campaign of the Louisville Gas & Electric Company, Mr. Robert Montgomery, manager of the commercial department of the company, has been able to get better results with five salesmen than were previously obtained when eight were working. These solicitors are restricted to making contracts for the wiring of old houses and are keeping up the average well, having signed up forty-nine contracts in a recent week.

The principal prize awarded is $10 in cash for what is termed "efficiency." The number of calls made by the salesman do not figure in this, the winner being determined by the amount of business he gets, computed in terms of kilowatt-hours, the amount of overtime he puts in, the neatness of his reports, his promptness in reporting and the absence of mistakes in his contracts. Record is kept on a blackboard in plain view of all the employees in the office so that each man is able to determine each day just where he stands with respect to the other solicitors. In addition $10 is given in weekly prizes. Only the volume of business turned in during the week by the men is figured in the award of these weekly prizes. The man who gets the most business receives the six-dollar prize and the man next to him gets $4. Mr. Montgomery has found that this method of stimulating his salesmen has done more to increase their efficiency and to get returns for the company than any plan previously tried. The salesmen are kept keyed up all the time and accomplish large results.

Forewarning the Prospective Customer

In many instances a prospective user of electric service waits until "the last minute" before giving his order to the central-station company to have connection made. When such a belated order finally does arrive it is usually without previous notice, the customer is invariably in a great hurry, the company is required to attempt a rushed and overtime job, and even then the efforts sometimes ends in disappointment for the customer owing to the absence of lines, connections, certificates of inspection, etc., necessary to complete the installation by nightfall.

To minimize this trouble the Southwestern Gas & Electric Company, Shreveport, La., makes use of warning tags which its meter readers, construction men, etc., are instructed to affix in prominent positions in each new dwelling or business structure they note along their routes. These tags read: "Please notify us when service is wanted and if possible ahead of time. Do not wait until the last minute. This is very important for new houses, as the connections may not be in and the city inspectors must issue certificates before service can be given. If you intend to move, arrange with our office in advance for the date."

Central-Station Company Gives Away 500-Watt Fixtures

Since the first of the year the United Electric Light & Power Company, of New York, has been offering 500-watt tungsten fixtures to its consumers without charge, provided they install the necessary wiring for the lamps. Up to the middle of June 1300 of these fixtures had been thus installed and the lighting load increased accordingly. During the campaign illustrated circulars with return postal cards attached were sent to the company's customers calling their attention to the advertising value of well-illuminated stores and requesting them to allow a central-station representative to call and install one of the units. Accompanying the text were several halftone reproductions of business houses where these tungsten fixtures are used for interior and exterior illumination. The units offered were very attractive, consisting of milk-glass bowls and fixtures suspended from either chains or outriggers, depending on whether exterior or interior illumination was desired.

Growth of Central-Station Business in Detroit

Compared with last year, the output of the Edison Illuminating Company and the Peninsular Electric Company, of Detroit, exhibits a healthy but not remarkable increase. The number of customers added to the system of these companies (which are operated together by one organization, being controlled by the Detroit Edison Company) during the month of April, 1914, was 1770. In May the number of new customers secured was 1701, while in June the estimated addition was between 1650 and 1700.

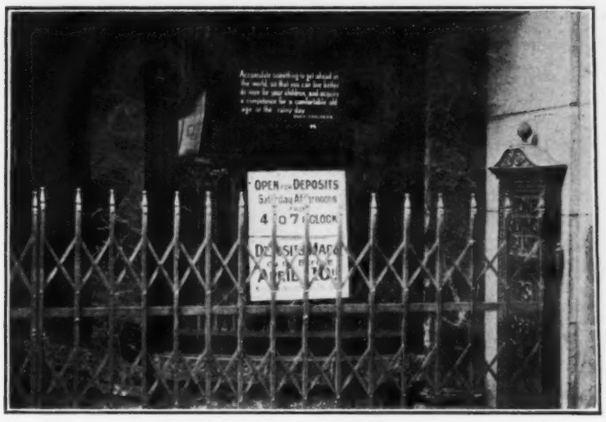
Detroit is pre-eminently a city of homes. The electric-service companies have about 85,000 customers, and of these perhaps 70,000 are residence customers. Statistics show that 39.1 per cent of the residences in Detroit are occupied by their owners. It is doubtful whether any large city in the country can show a larger percentage of householders owning their own homes. This fact is reflected in central-station business.

Miss Sarah M. Sheridan is the sales manager of both the Edison and the Peninsular company. The sales department of this system in Detroit has wide scope, having charge of all public dealings. It might be called the public relations department. All complaints come to it, and it oversees the meter and construction departments in so far as the duties of these departments relate to customers' installations. Not only does the sales department keep in close touch with every industrial prospect in Detroit but it also makes a point of keeping on friendly terms with existing customers.

Illumination and Wiring

Electrical Transparency in Massachusetts Savings Bank

The Home Savings Bank, of Boston, Mass., is a consistent user of electricity in advertising its service, and in harmony with the historic local "atmosphere" in which it transacts business quotations from Benjamin Franklin and other advocates of thrift are often displayed by electrical transparencies hung in the windows after the closing hour. The accompanying photograph illustrates a quotation from a modern writer on business, set up in transparency form, the display being about 24 in. long by 12 in. high and lighted by two 40-watt tungsten lamps mounted behind the lettering. The transparency can be read with ease at a distance of 15 ft., and it receives a good deal of attention from persons walking down town in the evening hours.



AN ELECTRICALLY LIGHTED LESSON OF THRIFT

Tower Lighting of a Railroad Yard with Quartz-Tube Lamps

Under the supervision of Mr. D. P. Morrison, chief electrician of the Pittsburgh & Lake Erie Railroad, that company is now trying out a new system of freight-yard lighting. The experiment is being conducted in the McKee's Rocks classification yard near Pittsburgh, Pa.

Ordinarily poles supporting electric lamps in railroad yards are from 25 ft. to 30 ft. high and the light from the lamps in the midst of a crowded yard is practically lost. With this new system, however, eight steel towers, 100 ft. high and 12 ft. square at the base, have been erected at approximately 500-ft. intervals along the boundaries of the tracks. At the tops of these towers Cooper Hewitt quartz-tube lamps, operating on a 220-volt direct-current circuit, supply the illumination. Each of these lamps requires about 726 watts and the specific energy consumption is said to be about 0.33 watt per candle.

FIG. 2—THE M'KEE'S ROCKS YARDS AT NIGHT

FIG. 1—QUARTZ-TUBE LAMPS ON STEEL TOWERS IN PITTSBURGH RAILROAD YARD

In the earlier days of arc lighting several cities, among which were Detroit, Mich., and Fort Wayne, Ind., attempted city lighting from similar towers, using banks of arc lamps to supply the illumination. These systems have come into disfavor, owing probably to the difficulty encountered in trimming the lamps. Linemen in some cases lost their lives by coming in contact with live parts of the lamp and being thrown from the tower. With the quartz-tube lamp, however, it is thought that this objection of trimming will be almost entirely eliminated, as the intervals between trims will be greatly extended. Two quartz-tube lamps operating in similar service near Chicago have been in operation since November, 1912. These lamps are hung at the tops of 60-ft. towers, and it is considered notable that one of these lamps had never been retrimmed up to the time this was written, while the other has been retrimmed but once.

Ten Miles of Tungsten Boulevard Lighting Completed in Chicago

With the completion of work on the Hyde Park Boulevard 10 miles of ornamental tungsten lighting under the jurisdiction of the South Park Commissioners, Chicago, has been put into operation. Divided into two systems, the main portion of the lighting, beginning at Eighty-third Street and Bond Avenue, is placed as shown on the accompanying map, skirting the property of the South Shore Country Club and the southern end of Jackson Park. From the park the route extends along Sixty-sixth and Sixty-seventh Streets to its western limit, Ogden Park. Crossing this line at right angles, a similar installation lights Normal Boulevard from Hamilton Park to Garfield Boulevard. On Hyde Park Boulevard, the more recently completed section of the work, the lighting extends from the shore of Lake Michigan to Drexel Boulevard, almost to Washington Park.

Energy for the operation of the lamps in this instal-

FIGS. 2 AND 3—VIEWS ON HYDE PARK BOULEVARD

lation is secured from the mains of the Sanitary District and delivered through seven substations to the lamps on 2300/4000-volt, sixty-cycle circuits. Two of these substations contain stepdown transformers for reducing the potential from 12,000 volts to 2300 volts, while in others the equipment consists only of auto-

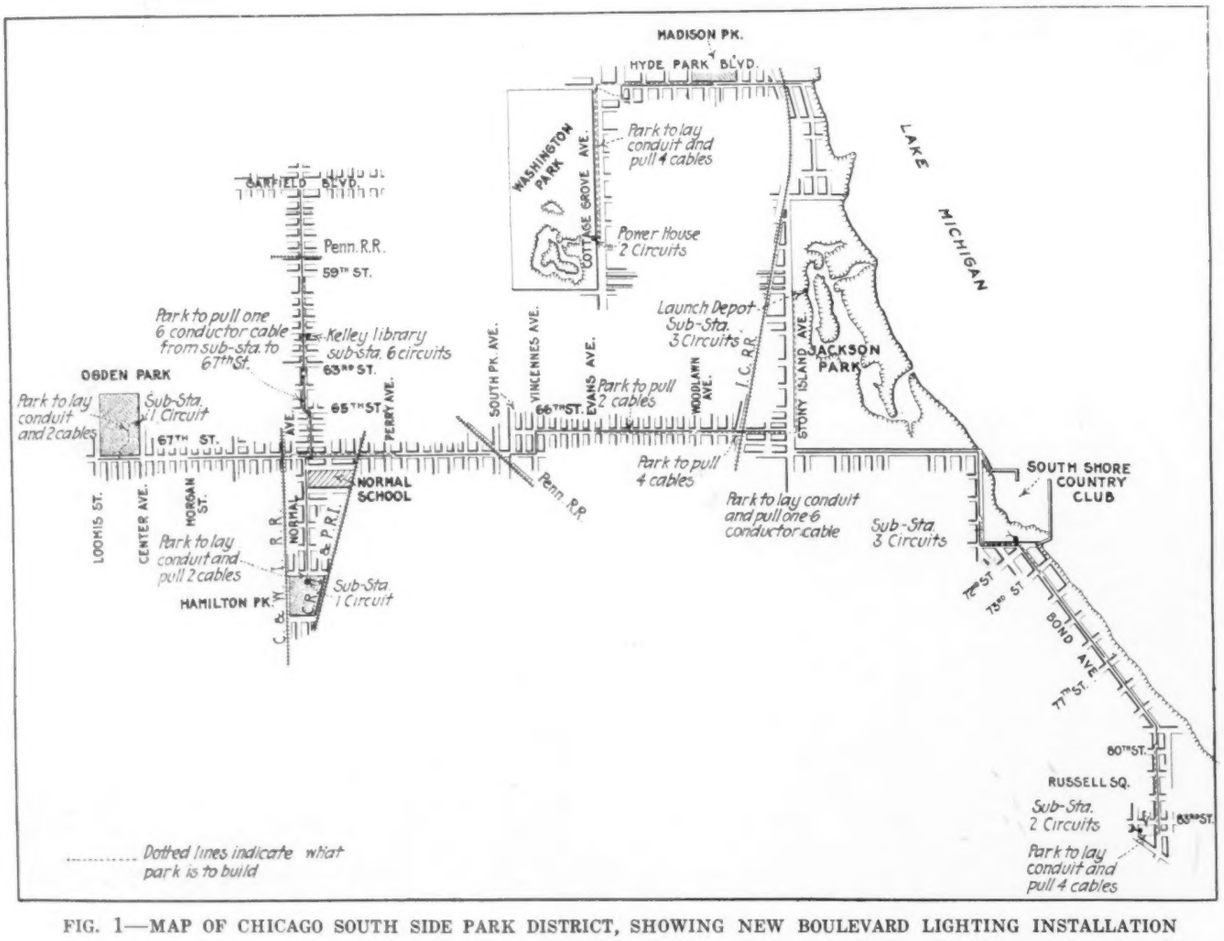


FIG. 1—MAP OF CHICAGO SOUTH SIDE PARK DISTRICT, SHOWING NEW BOULEVARD LIGHTING INSTALLATION

matic constant-current transformers and regulators, together with the necessary switching apparatus and instruments. In all there are sixteen constant-current transformers, each capable of supplying energy for fifty-series lamps. The number of lamps on any one circuit varies from twenty-two to fifty-three.

Standing on an octagonal base, the slender cast-iron posts present a graceful and attractive appearance. The post proper is about 12 ft. in height and the surmounting globe measures 1.5 ft. in diameter. By proper arrangement of the socket within the globe the center of the lamp filament occupies approximately the center of the globe, giving an even and almost perfect diffusion of the light. The series tungsten lamps used in the globes are rated at 7.5 amp, 250 watts, and the illumination provided makes the South Side boulevards as brightly lighted as any in the city. Spaced on approximately 75-ft. centers and installed opposite each other on both sides of the street, 960 of these lighting units were required to carry out the lighting scheme as shown in Fig. 1.

As a feature of the installation attention should be called to the special combination pot-head and receptacle used in the top of each post. As is shown in the cross-sectional drawing (Fig. 4), No. 6 insulated copper leads enter from the underground fiber conduit through the hollow post and pass through holes in a porcelain bushing. A heavy layer of tape wrapped about the lead sheath retains the cable in position.

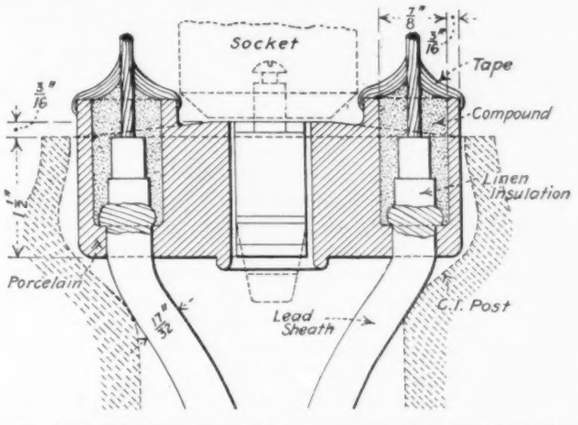


FIG. 4—CROSS-SECTION OF POT-HEAD AND RECEPTACLE

When the ends of the cable have been properly skinned pot-head compound poured into the porcelain receptacles seals the joint. The bare ends of the wire which protrude are then connected to the socket terminals by means of set screws.

The engineers for the South Park Commissioners are Messrs. W. I. Bell and F. Brueggeman.

Inexpensive Lighting for a Modest Summer Garden

By erecting lighting posts along two sides of his summer garden a thrifty Italian who supplies refreshments to park visitors and baseball fans in the western part of St. Louis has given his establishment a bright and cleanly appearance generally lacking in such places. That the installation is inexpensive is evident from the illustration, for the bodies of the posts are made up of 4-in. by 4-in. pine timbers painted green. Surmounting each post an ordinary porcelain socket carries a 25-watt tungsten lamp. Around the top of each socket a brass fixture has been clamped so that it supports an inverted globe of the type commonly used with smaller sizes of inverted gas mantles. This globe not only acts as a diffuser for the rays of the 25-watt lamps, but also helps to protect the socket from the weather.

ELECTRIC LIGHTING IN A MODEST SUMMER GARDEN

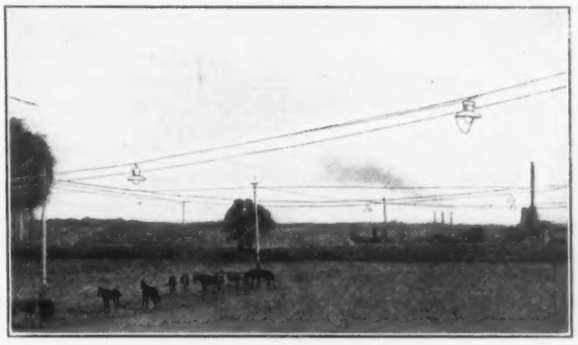
By carrying the multiple-circuit wiring along the top of the posts from lamp to lamp, the cost was held down to the minimum. The circuit is controlled from inside the corrugated-iron building which houses the electric meter and the Italian's stock of goods.

A Printer's Illuminated Proof Table

For aligning the margins of proofs of book pages which are to be printed on both sides of the sheet, a Philadelphia printing house now saves much time by the use of a novel glass-topped proof table, beneath which are mounted several tungsten lamps. When the proof sheet, printed on both sides, is laid on this illuminated table the transmitted light shows at a glance where the page forms fail to register, and the time required to align proofs is eight minutes instead of twenty.

Military Drill by Artificial Light

Troop B of the Missouri National Guard stationed at St. Louis, Mo., in command of Capt. A. C. Orrick, has been drilling in the open at night on a parade ground illuminated by tungsten lamps. The entire lighted inclosure measures about 530 ft. by 486 ft., part of this space being taken up by the barracks and stables. In front of the stables six 30-ft. poles have been erected in two rows, 150 ft. apart. The poles are spaced at 80-ft. intervals. In the three 150-ft. spans strings of five 250-watt tungsten lamps have been installed. These units not only illuminate the 150-ft. by 160-ft. space directly beneath them, but also shed enough light on the surrounding parade ground to allow the maneuvers to be executed on any part of the open area.



PARADE-GROUND LIGHTING

Recent Telephone Patents

To obviate the necessity of holding a receiver to the ear, Mr. H. W. France, London, England, has designed and patented a sound trumpet which can be attached to the front of a receiver.

Mr. T. L. Savin, Pine Bluff, Ark., is the patentee of a device for referring a calling party to another telephone number when the original call is unanswered. The ringing of the bell at the unanswered telephone station causes a motor to lift the hook switch and strike signals near the transmitter indicating where the called party can be reached by telephone.

Telephone Conductor

In designing a submarine cable Mr. I. Kitsee, Philadelphia, Pa., has made use of the principle that two insulated conductors in close physical relation will, through their mutual capacity, serve as a telephone conductor. The conductors in the cable patented by him are arranged in pairs, wrapped with braid and incased in a shell made of fine metallic strands. This shell, which is grounded, protects the conductors within from any eternal inductive disturbances. The entire cable is incased in an impervious metallic sheath, surrounded by an armor of insulated wire. Interstices are left in the latter to permit contact of the water with the sheath.

Telephone Circuit

Another patent granted to the same inventor describes a loop telephone circuit in which the stations are located at intervals, with the batteries connected at diametrically opposite sides of the circuit. At each station is a single-stroke bell, connected in series with the line, but shunted by a condenser. A telegraph key is similarly connected at each station, so that signals may be transmitted to all bells simultaneously. Each telephone-transmitter circuit, including the primary of the induction coil, is bridged across its respective bell coil but is open when the hook is down. Each receiver circuit, which includes the secondary winding of the induction coil and a condenser, is connected across the line when the switch hook is raised. When conversation is being carried on, the talking current traverses the receiver circuits of all listening stations. The current is prevented from passing through the batteries, however, by placing retardation coils in series with them. The patent has been assigned to the Western Electric Company.

Letter to the Editors

Electric Lamp Development

To the Editors of the Electrical World:

SIRS:—In the *Electrical World* of March 7, 1914, Mr. E. R. Knowles writes concerning the nitrogen "vacuum" lamps manufactured by Sawyer and Man in 1880. It is true that Mr. Sawyer produced lamps of this type at about the date noted and also that others were working with nitrogen and other gases in lamp bulbs during this period, but work had been done much earlier along the same line.

One of the first investigators, if not the first, to produce what may properly be termed an incandescent lamp was W. R. Grove, the inventor of the "Grove" cell. It is noteworthy that Faraday, previous to this time, had proposed "inclosing wire in a tube for the purpose of being able to ignite a longer portion of it." In 1840 and 1841 Grove was using for lighting his laboratory an incandescent lamp which embodied some of the principles of our latest lamps. He used a metallic filament. Not knowing how to reduce tungsten powder to a wire, he used platinum as the best metal available for a filament, and arranged the wire in the form of a helix, the spirals of which were brought as close together as possible, "as each aids by its heat that of its neighbor, or rather diminishes the cooling effect of the gaseous atmosphere. The wire should not be too fine, as it would not then become fully ignited. The helix form offers the advantages that, the cooling effect being lessened, a much longer wire can be ignited by the same battery. By this increased length of wire, the battery fuel is economized, while a greater light is afforded. By the increased heat, the resistance is still further increased and the consumption still further diminished." Here we see not only the metallic helix, but also the beginning of an attempt for a high-resistance lamp later worked on by Edison.

Grove's lamp was made by inverting over water a beaker within which the filament was placed, the insulated leading-in wires dipping under the edge of the beaker. Grove realized, however, that the result could be accomplished better by placing the wire in a glass globe into which the conducting wires were sealed.

The form of the latest nitrogen-filled tungsten lamp was even more closely approximated than this, for, realizing the effect of different gases on radiant heat, Grove tried filling his lamp at approximately atmospheric pressure with a number of different gases, hydrogen, carbon dioxide, oxygen and nitrogen. As nearly as he could observe the candle-power was the same in oxygen, nitrogen and air, using in each case the same battery, which consisted of two or three pairs of Grove cells. He measured roughly the power consumed and discovered that with nitrogen and air less power was used than with the other gases; hydrogen and carbon dioxide, besides taking considerably more electrical power, gave very much lower candle-powers.

We see then that more than seventy years ago very many of the ideas contained in the latest lamp development had been tried and noted. Very soon after this Starr patented his carbon-filament vacuum lamp. The work on incandescent lamps since that time has been largely a repetition of the earlier attempts, alternating between metallic and carbon filaments and between vacua and nitrogen atmospheres.

Another type of lamp which has come into use comparatively recently, the mercury-vapor lamp, was employed as early as 1861, when signals were flashed from Fort Washington to the White House using the lighthouse lantern with the mercury-vapor lamp as a source of light. And in 1862 Geissler tubes (vacuum-tube lighting) were proposed for mine illumination.

It might be interesting to note here that another one of the recent developments—indirect lighting—was also utilized in the early days of electric light. Perhaps the first commercial interior lighting system was that installed in one of the Paris railway stations, in 1877. In this installation use was made of the old Reynier "semi-incandescent" lamp with a large carbon block at the bottom, throwing a large percentage of the light of the lamp upward. This plan may well be considered a defect in this lamp, but advantage was soon taken of the natural light distribution. Reflectors were placed beneath the lamp, and the entire illumination of the station was obtained by the light reflected from the ceiling.

These earliest lamps were put aside and practically forgotten for a generation. Then about 1870 a new generation came in, and with the development of the dynamo the commercial use of the electric lamp became assured.

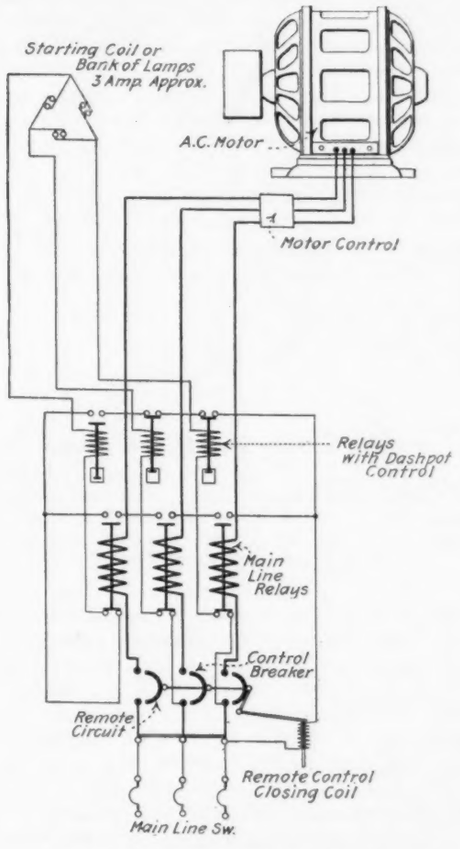
Urbana, Ill. E. H. WALDO.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Automatic Control for Alternating-Current Motor

Situated in isolated positions as they generally are, automatically controlled motors need to be protected by apparatus which will remove them from the line if trouble occurs on any one phase, and to make the automatic service of true value the same control apparatus must replace the motor in operation when the circuit



AUTOMATIC MOTOR-CONTROL CIRCUIT

has been restored. Such a control circuit, together with apparatus for stopping and starting an alternating-current motor, has recently been designed by Mr. Nels Joleen, of the Commonwealth Edison Company, Chicago.

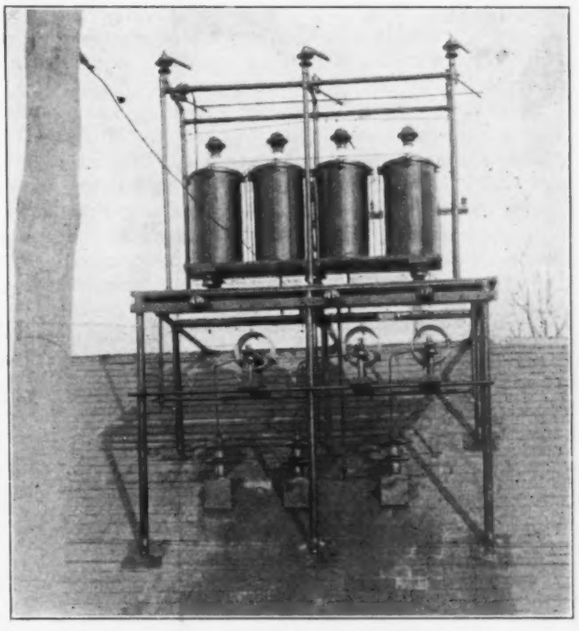
Tracing the connections on the sketch herewith, the main three-phase circuit is conducted to the motor through fuses, a remotely controlled circuit-breaker and main-line relays. With the motor at rest the main-line relays retain the position shown in the illustration, and the application of energy to the motor service line lights the lamps, which act as a temporary auxiliary load. Electricity flowing in the lamp circuit energizes the three smaller relays, bringing their armatures to the "up" position to close the three sets of series contacts which are arranged in the same circuit with the remotely controlled closing coil of the main-line circuit-breaker. With the closure of this breaker energy flows to the motor, lifts the armatures of the main-line relays and shunts the auxiliary starting apparatus and temporary load out of the circuit.

The failure of the energy supply in any phase interrupts the operation of all three phases and shuts down the motor. As will be seen, the application of the circuit of this type eliminates the necessity of stringing any but the three-phase motor-service circuit between the source of the energy supply and the remotely controlled motor.

Mounting Lightning-Arrester Equipment on Roof of Substation

Since the consolidation of the Evansville Gas & Electric Light Company, the Evansville Public Service Company and the Evansville & Southern Indiana Traction Company, many improvements have been made in the service rendered the public by the interurban and traction line as well as by the central-station company itself.

In addition to installing new feeders on practically all of the city traction lines and extending its trackage



LIGHTNING ARRESTERS INSTALLED ON ROOF OF SUBSTATION

system the new organization operating these utilities, known under the name of the Public Utilities Company and the Evansville Public Service Company, has converted the transmission line feeding the interurban substation from a 11,000-volt line to a 22,000-volt line. In so doing it has remodeled the substations at Bauer and at Princeton, Ind., and has installed the lightning

arrester equipment on the roof as shown in the accompanying illustration. This arrangement has avoided building an elevated platform or extending the substation to receive it.

The installation which is shown in the illustration printed on the preceding page is the one in use on the substation roof at Princeton, Ind.

Reducing Bills for Compressor Service

Starting a large air compressor under load not only imposes undue strains upon the compressor and motor but also establishes an exceedingly high reading on the customer's maximum-demand indicator. Where a compressor is automatically operated, as is the one in the accompanying diagram, a momentary interruption in the energy supply establishes such an overload condition, and the result is that customers complain of high bills created by high maximum demands.

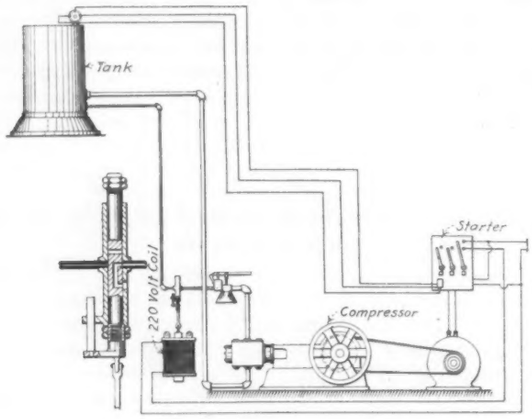


FIG. 1—AUTOMATIC INTAKE-CLOSING DEVICE

To obviate this difficulty, Mr. Nels Joleen, Commonwealth Edison Company, Chicago, has invented the scheme shown in the sketch herewith. When the motor-service circuit is interrupted the operation of the starter contactor interrupts an auxiliary 220-volt circuit to a small coil shown at the left-hand side of the illustration. This coil, becoming de-energized, opens the valve in a small pipe line, admitting air into the cylinder shown in detail in Fig. 2. The pressure of the air on the piston in the cylinder acts through the lever to close the compressor intake. Once this intake is closed, the load on the air compressor is reduced, and it may be started again without trouble. However, as soon as the controller has reached the full running position the last contactor closes the 220-volt circuit to the coil and releases the pressure from the small piston. With this operation completed the air intake automatically opens, this operation being retarded only by a small dash-pot.

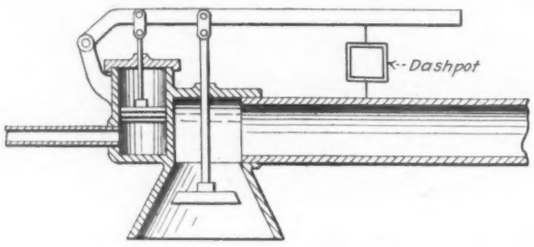
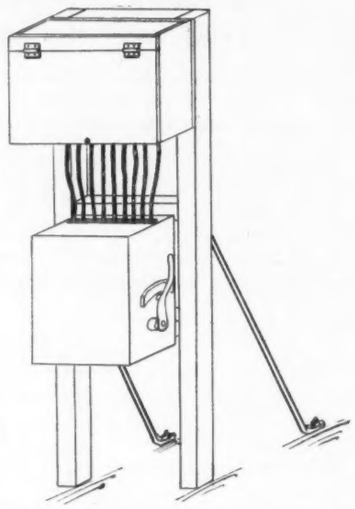


FIG. 2—DETAIL OF INTAKE

Support for Compensator Case

A wooden frame adaptable for supporting all sizes of compensators and fuse cabinets is shown herewith. It consists of two vertical two-by-fours fastened at the middle and top by crosspieces of the same stock. The frame may be painted a dark color and braced as shown. This method of support has been used extensively in large railway shops. With a compensator supported in this manner it is advisable to ground the casing to prevent accidents.



FRAME TO SUPPORT COMPENSATOR

Regulation and Motor Speed

A 200-volt shunt-wound motor is connected in a 250-volt direct-current system. The load on the generator pulls the voltage down, especially so if the steam happens to go down. Is there any way to regulate the voltage? Will an alternating-current motor run with a steady speed regardless of the line drop?

D. J. C.

When the load on a plain, shunt-wound generator increases, the voltage at its terminals falls off, although the generator may continue to run at constant speed. The drop in voltage is attributable to the loss in the resistance of the machine. This voltage drop, in turn, decreases the excitation, which then further decreases the terminal voltage. Therefore means must be employed to increase the excitation sufficiently to overcome both of the above effects. This falling-off in pressure is in practice counteracted by means of a field winding in series with the armature of the generator. If the direct-current motor referred to in the first part of the query is so designed that it can be operated with its field core at low magnetic density, its speed will be only slightly affected by voltage variations. Coming to the last question, there are two kinds of alternating-current motors to be considered, the synchronous motor and the induction motor. The synchronous motor will run at a constant speed provided the frequency is constant. The induction motor, however, will not run at constant speed when the voltage varies. The induction motor runs at a speed less than synchronous by an amount proportional to the percentage of loss in the secondary. On a lower voltage the losses will be increased slightly, and the loss percentage at a greater rate. Thus the motor will drop somewhat in speed. The decrease in speed, however, is only slight. The percentage drop in speed might be in the neighborhood of 10 per cent of the percentage of voltage drop.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Polyphase Series Motors with Double Sets of Brushes.—J. JONAS.—The author describes a method of regulating the speed of polyphase series motors with a double set of brushes by means of displacement of the brushes. In this method, by displacing only one set of the brushes the motor is brought from the range of good phase compensation into the range of stable conditions at low speeds. It is necessary that the currents of the two sets of brushes be different. The set of brushes which carries the greater current must be stationary and the number of rotor ampere-turns produced by the current of the stationary set of brushes must be smaller than the number of stator ampere-turns. In the case of motors designed for higher voltages it is advantageous to use series transformers with the primaries connected in series and the secondaries in opposition for the current supply of the rotor. Motors of this kind are suitable for speed regulation when the speed has to vary according to several periodic laws. Instead of depending on an oscillating motion of the one set of brushes a revolving motion may be employed, and this will simplify considerably the design of the controller.—*Elek. Zeit.*, June 18, 1914.

Rectifier.—H. GREINACHER.—A description of an aluminum rectifier for rectifying alternating current into continuous (not undulating) direct current, for use with very small currents for ionization experiments.—*Elek. u. Masch.* (Vienna), June 7, 1914.

Transformer Oil.—W. BRAUEN.—An abstract in English of the author's recent German paper on the properties and suitability of different oils for use in transformers.—London *Electrician*, June 19, 1914.

Lamps and Lighting

Ductile Tungsten.—A note on a recent British patent (No. 8956, 1913) of A. Just. In this process a small percentage of another metal, such as vanadium, molybdenum, chromium or tantalum, is added to previously prepared pure tungsten and the mixture is gradually heated up to about 2000 deg. C. according to the ordinary sintering process, or else the mixture is melted at a temperature of 3000 deg. C. In both methods the maximum temperature must be maintained for some time to allow the tungsten to dissolve the added metal. The mixture is then suddenly cooled so that a crystalline solid solution of one of the above metals in tungsten is obtained. This product is then tempered in an electric furnace in a stream of pure hydrogen or nitrogen, and is then found to be well suited for wire-drawing.—London *Elec. Eng'ing*, June 18, 1914.

Arc-Lamp Carbons.—A note on a recent British patent (No. 22,319, 1913) of H. Ayrton. The negative electrode consists of a tubular rod of carbon coated on the outside with a thin metallic film, preferably of copper. The object of this film is to regulate the rate of burning of the negative carbon. By having the film of suitable thickness, the negative carbon can be made to burn away at the same rate as the positive electrode. It is found that increasing the thickness of the film makes the carbon burn more slowly.—London *Elec. Eng'ing*, June 18, 1914.

Generation, Transmission and Distribution

Disconnection of Lines.—W. PETERSON.—An illustrated article on the transient phenomena which occur when a slightly loaded or an unloaded line is disconnected. After a phase has been disconnected there occurs during the first half cycle a reconnection of the phase, together with rises of voltage which may become dangerous either to the machines and transformers or to the disconnected line. The author calculates to what amount these voltages can rise.—*Elek. Zeit.*, June 18, 1914.

Dangerous Voltage Rises on Transmission Lines.—M. OUBOUKHOFF.—An article illustrated by diagrams on the protection of lines and machines against dangerous rises of voltage and also on a new protective device called the resonance voltage-limiting device.—*La Lumière Elec.*, May 16, 1914.

Boiler-House Plant.—S. E. FEDDEN.—A paper read before the (British) Municipal Electrical Association on the design and operation of a modern boiler-house plant. The author first considers the design of a modern boiler-house plant with special reference to the Neepsend station of the Sheffield Corporation, attention afterward being paid, in a more general way, to the questions of ash handling, coal measuring, boiler selection and rating, mechanical stoking and boiler-house organization.—London *Electrician*, June 19, 1914.

Traction

Starting Resistances for Traction Motors.—H. PARODI.—The author shows how by means of a set of curves once plotted it is possible to determine exactly by a graphical method the values of the successive starting resistances for a direct-current series-motor for electric locomotives.—*La Lumière Elec.*, May 23, 1914.

Storage-Battery Traction.—M. BUTTNER.—An English translation of his recent German paper on the development of storage-battery traction on German railways.—Translated in abstract from *Elek. Kraftbet. u. Bahnen* in London *Electrician*, June 5, 1914.

Installations, Systems and Appliances

Rates for Electrical Energy.—ROBERT ARBEITER.—A paper read before the Vienna Electrical Society in which the author discusses critically the following three different rate schedules: first, the meter rate on the basis of the kilowatt-hours consumed; second, the flat rate on the basis of the kilowatt maximum demand, and, third, rates which take both the kilowatt-hours consumed and the maximum demand into consideration.—*Elek. u. Masch.* (Vienna), June 7, 1914.

Standardization of Rates.—J. HORACE BOWDEN.—A long paper read before the (British) Municipal Electrical Association. The author discusses, in great detail, a proposed rate system which could be employed in any community and so help toward standardization of rates. If this system were adopted, two fetishes of the electrical industry—viz., "diversity factor" and "load factor"—would go out of existence.—London *Electrician*, June 19, 1914.

Electric Heating and Cooking.—F. BRENDEL.—An illustrated description of modern designs of electric cooking utensils and water-heating apparatus, with automatic disconnection during hours of peak load on the central station.—*Elek. Zeit.*, June 11, 1914.

Electrophysics and Magnetism

Surface Leakage Over Insulator.—HARVEY L. CURTIS.—An abstract of a paper presented before the American Physical Society. The resistance between two conductors insulated by a solid dielectric usually depends very largely on the surface condition of the dielectric. If the insulator is in a humid atmosphere, condensation of moisture is known to take place on the surface, and this increases the surface leakage. In the present paper an attempt is made to find a connection between the moisture condensed and the surface leakage. The surface resistivity is defined as the resistance between two opposite edges of a surface film which is 1 cm square. The surface conductivity is the reciprocal of this. The surface resistance of most insulators varies greatly with the humidity of the surrounding air. In one case (hard rubber which had been exposed to the sunlight) the surface resistivity in very dry air was nearly one trillion (10^{12}) times as large as in very humid air. With waxy materials such as paraffin, ozokerite and beeswax, there is very little change with the humidity but all other insulators show marked changes. A factor of 10^5 or 10^6 between high and low humidities is not uncommon. It is to be expected that this change in surface resistivity is due to condensed moisture. The thickness of the surface film of water upon quartz and glass has been determined by weighing. Knowing this thickness and the surface resistivity, the conductivity of the surface is readily computed. In the case of waxy materials water does not spread over the surface, but collects in drops. Hence one would not expect any change of surface resistivity with humidity.—*Phys. Review*, June, 1914.

Electrochemistry and Batteries

Instrument for the Control of Storage Batteries.—R. RANKIN.—Batteries suffer greatly from any overdischarge, and this is especially serious with the batteries of electric automobiles. The author describes an instrument which prevents such damage. The operation of this instrument depends on the fact that for every value of battery current there is a definite final value for the voltage of each cell, below which it is unsafe to go. The arrangement of the working parts of the instrument is such that when the final value of the voltage is approached, corresponding to the current at any moment of working, this fact is indicated at the switchboard, and if the voltage is actually reached an alarm may be given, or a record made, or both. The instrument shows the total battery voltage, actual voltage per cell, permissible final voltage per cell, and actual value of current. There are two movements in the instrument, one that of a coil, the displacement of which from its zero position varies with the value of the battery current, the other that of a second coil, the displacement of which varies with the voltage of the whole or part of the battery. The former, or current coil, moves an arm in such a way that the movement of the arm is proportional, not to the value of the current, but to the value of the permissible final potential difference corresponding to that current, whatever the current may be. This arm may, therefore, be made to move over a scale of voltages which may be calibrated in terms of volts per cell, and over which a pointer may move which is actuated by the second or voltage coil previously referred to. This latter pointer will—on discharge, of course—always point to a higher voltage than the current-coil arm, which may be termed the limit indicator, until the limiting value of the voltage is reached on discharge, when the two will coincide, and it is the approach of the voltage pointer to the limit indicator which warns the attendant to be careful and the final coincidence which operates the alarm or makes the record. The principle of operation of the instrument is shown diagrammatically in Fig. 1. *A* is the movement responsive to current and *B* that responsive to voltage. *A* moves the limit indicator *C* through a cam face on the part *D*, so that it takes up the correct position on the scale *E*, corresponding to the value of the current flowing. The movement of the voltage pointer *F* is independent of that of *C*, but coincidence of its position with that of *C* completes a circuit, if necessary, which rings a bell or makes a record, or otherwise gives an indication that the limiting conditions have been passed. The alarm will sound until the current has been reduced to a safe value or the battery circuit broken. Where it is permissible, as is frequently the case, to make the final allowable potential differences directly proportional to the current, the link between the current coil and the limit indicator may be omitted, the latter being fixed directly on the coil.—London *Electrician*, June 19, 1914.

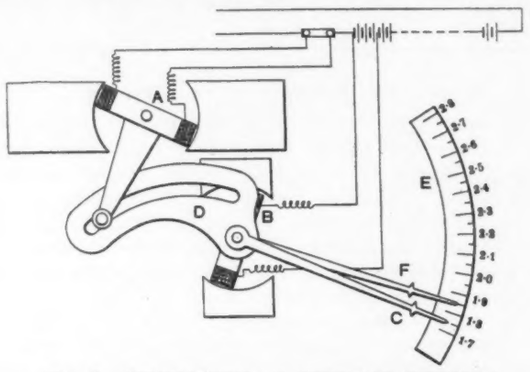


FIG. 1—MECHANISM OF OVERLOAD DETECTOR

Copper-Nickel-Manganese Resistor Alloy.—GEORGE L. GRAY.—An account of an investigation the object of which was to find the effect of the addition of manganese in various quantities upon the resistivity and temperature coefficient of copper-nickel alloys. The chief results are as follows: Within the limits covered by the investigation the addition of manganese to the alloy of copper and nickel at any concentration causes an increase in resistivity. The conclusion of Liebenow that the curve of temperature coefficients is of the same general shape as that of conductivities is confirmed in the case of alloys of copper, nickel and manganese. The conclusion of Liebenow that an increase of resistivity is accompanied by a decrease of temperature coefficient is in general confirmed for the alloys of copper, nickel and manganese. The curves obtained indicate that there is an alloy containing approximately fifty-five parts copper, forty-five parts nickel and fifteen parts manganese, which has a specific resistance of about 70 microhms per centimeter cube. The temperature coefficient of this alloy is zero at 20 deg. C. This alloy is a much better resistor than any of those used at the present time for precision apparatus. It should replace all other alloys which are at present used in this field. Further work will be done upon it to extend its use commercially.—*Rensselaer Polytechnic Institute, Engineering and Science Series*, No. 4, 1914.

Units, Measurements and Instruments

Testing of Electric Properties of Insulating Materials.—A. SCHWAIGER.—The author points out that the

"perforation stress" (the perforation voltage per centimeter of thickness) of an insulating material does not completely determine its insulating qualities. The author proposes to determine the perforation stress indirectly as follows: In Fig. 2 *a* is the dielectric whose insulating qualities are to be determined. It is placed between a spherical electrode *b* and a plate electrode

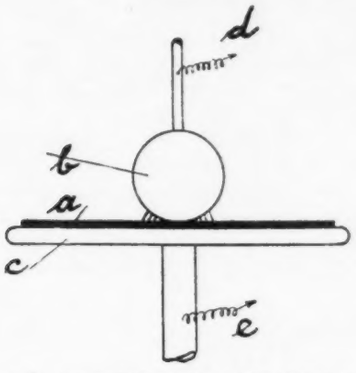


FIG. 2—EXPERIMENTAL ARRANGEMENT

c, and connections to the alternating-current supply are made at *d* and *e*. If the voltage is low, nothing happens, but when it is above a certain value there is a brush discharge, as indicated in the illustration. The voltage is kept constant for a certain time and after the current has been interrupted it will be found that the brush discharge has produced on the dielectric a marked space in the form of a circle which is called the "brush circle." The diameter of the circle is measured. The voltage is then raised somewhat higher and kept constant again for some time. The brush discharge is then found to produce a "brush circle" of a larger diameter. This experiment is repeated for higher and higher voltages and a diagram is plotted with the diameters of the circles as abscissas and the voltages as ordinates. It will be found that the curve changes its form somewhat where the brush discharge passes over into another form of discharge ("büschel" discharge), and again when it changes into spark discharge. These experiments are repeated with spherical electrodes of different diameters, the author using diameters of 1, 2, 5, 10 and 15 cm. In this way a series of curves is obtained, and from this series of curves new curves may be plotted which connect the characteristic points at which one form of discharge changes into another form of discharge. The author thinks that these curves define very fully the insulating character of a dielectric.—*Elek. u. Masch.* (Vienna), June 7, 1914.

Telegraphy, Telephony and Signals

Inductive Effects of Traveling Waves on Telephone Lines.—KARL WILLY WAGNER.—Among the problems which are at present of particular interest, the disturbances in telephone lines caused by induction from high-tension transmission lines in the neighborhood have led to many discussions between telephone engineers and transmission engineers. These disturbances are due to various causes and not all of them are thoroughly understood. Those caused by transient traveling waves in the high-tension lines are least understood. The author shows how the traveling waves induced in the telephone lines can be calculated. In the first part he gives the theory of the traveling waves in a system of any number of lines in parallel. In the second part he applies the theory to various examples. He calculates the induction for the case where the telephone line is insulated and also for the case where it is earthed through a resistance, a condenser or a choking coil. He further calculates the induction caused by the sudden voltage rush due to the breakage of an insulator of the high-tension line. He also discusses the effect of an earthed ground wire on the induction phenomenon and the production of coupled oscillations in the case of resonance. The paper is highly mathematical; in the present instalment the general theory is given, with its application to a few special cases. The article is to be continued.—*Elek. Zeit.*, June 4, 1914.

Book Reviews

ELECTRIC LIGHT AND MOTOR WIRING. By George J. Kirchgasser. Milwaukee, Wis.: Electroforce Publishing Company. 142 illus. Pocket size, leather. Price, $1.

A vest-pocket book on this subject prepared to be especially useful to the workmen actually making the installation. The print is large, the use of mathematics is reduced to a minimum, the illustrations are prepared with a view to showing just how the work should be done, and the book is substantially bound in leather. One can scarcely agree with the statement in the preface that there is no other up-to-date volume describing the different wiring systems in detail and the National Electrical Code requirements regarding them, but the book is one of at least a few that do this in an excellent manner.

DIE WISSENSCHAFTLICHEN GRUNDLAGEN DER ELEKTROTECHNIK. By Prof. Dr. Gustav Benischke. Berlin, Germany: Verlag von Julius Springer. 606 pages, 551 illus. Price, 15 marks.

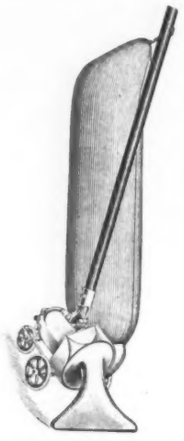
This is the third edition of Dr. Gustav Benischke's treatise on the fundamental principles and theory of electricity and magnetism. The subject is covered in a thorough and masterly manner, and although the author does not pretend to treat of the more practical aspects of electrical engineering, his book is an excellent text for engineering students as well as being a work of reference for engineers whose knowledge of fundamental theory does not always meet the requirements when a new line of work has to be undertaken. In a work of this description one does not expect to find much that is new in the matter of material, or original in the presentation of the subject; but, with the aid of good illustrations and diagrams and the introduction of the calculus when necessary, Dr. Benischke has covered the ground in a sufficiently comprehensive manner without being tedious or losing touch with the subject as a whole by going into unnecessary detail. This work does not belong to the class of elementary or preparatory books, but at the same time it does not assume much previous knowledge of physics or chemistry on the part of the reader, and each subject is taken up from the beginning. The ground covered includes: Fundamental principles of magnetism and electricity; electrostatics; the electric current, its nature and effects; electrochemistry (theory of primary and secondary batteries, and electrolysis); magnetic field due to electric currents; magnetic induction; electrodynamics; induced emf; single-phase currents; mutual induction-transformers; condensers; transient phenomena; wave shapes and harmonic analysis; polyphase currents; the passage of electricity through non-conducting mediums, Roentgen rays; sparking distances in air; porcelain insulators; the mercury-vapor lamp; principles of electric measurements; magnetic measurements, and the absolute and practical systems of units.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Suction Cleaner

The vacuum cleaner shown in the accompanying illustration is equipped with three rubber wheels, one of which, the rear wheel, is adjustable, making it possible to raise or lower the nozzle to suit the thickness of the



ELECTRIC SUCTION CLEANER

rug or carpet. The device weighs 11.5 lb. and is 7.5 in. high. The bag is double and dust-proof and the nozzle is 11 in. long and 0.5 in. wide. Oiling is accomplished by means of a wick held against the bearing by a spring. The fan is a one-piece aluminum casting. The motor is rated at 1/12 hp and operates on both direct current and alternating current. This cleaner and the motor used in running it are being manufactured by the Birtman Electric Company, Chicago, Ill.

Electric Tolling Bell

An electric tolling bell for use as a time signal or fire alarm in factories is being placed on the market by the General Electric Company, Ltd., Witton, Birmingham, England. By means of a time-switch or clock the bell can be rung at predetermined intervals.

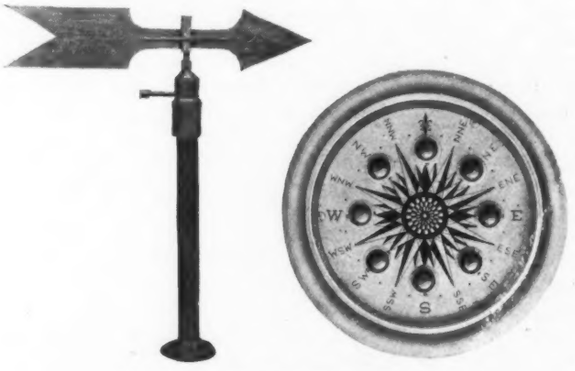
ELECTRIC FACTORY BELL

The striking hammer is connected to a rod which is screwed into an armature whose movement is controlled by a powerful electromagnet. In the top of the hammer rod is fixed an insulator arm with a metal projecting blade near the end. This blade passes in one direction along the length of the lower strip of metal which is attached to one of the poles of the electromagnet and connects this pole with the upper spring contact. On the return stroke the blade passes over the projection of the upper spring contact and the electric circuit is broken until the swing of the pendulum again makes contact. An insulating stud is provided to prevent the upper spring contact from touching the lower one when the connection is not made between them by the projecting blade on the arm fastened to the hammer rod.

The "Kingsway" electric tolling bell, as it is called, is made in two sizes. In the first or bracket type, shown in the illustration, the gong is approximately 12 in. in diameter and averages 42 lb. in weight. The energy required is 1 amp at 15 volts. In the second bell, which is more powerful, the gong averages 132 lb. in weight and measures approximately 17 in. in diameter.

Electric Weather Vane

Apparatus is now available which will indicate electrically at any convenient point the direction of the wind as determined by a remotely located weather vane.

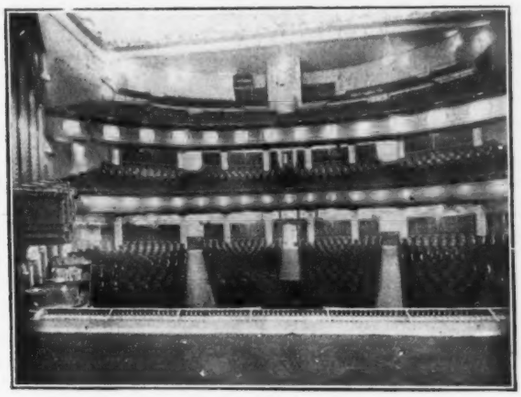


ELECTRIC WEATHER VANE

The movable element of the operating device consists of the vane proper, vertical shaft, inverted hood and brush-holder. The stationary part comprises two concentric vertical tubes (the inner one containing a bearing point covered with oil) and a commutator. The indicating device consists of a compass dial with an electrically illuminated lens at each of the eight major points of the dial. One terminal of each of the lamps illuminating the lenses is connected to a common conductor leading to a source of energy and thence to the inner tube of the operating device and the brush-holder. The other terminals of the lamps are connected respectively to the eight segments of the commutator. As the vane shifts with the wind the brush moves accordingly, making contact with the commutator segment connected to the proper point on the compass. The device is manufactured by Shotwell Electric Weather Vane, Inc., 32 Broadway, New York.

New Lighting for Old Theater

A new system of lighting was recently installed in the Pitt Theater, Pittsburgh, Pa. The main ceiling of this theater is about 40 ft. high. The main floor measures 80 ft. by 100 ft. and the first balcony 35 ft. by 100 ft. Three glass bowls, each equipped with a



INTERIOR OF PITT THEATER, PITTSBURGH, PA.

500-watt lamp, hang 20 ft. from the ceiling. In front of the second balcony are fourteen 8-in. glass acorns equipped with 40-watt lamps. In front of the first balcony are seventeen glass panels with two 16-cp carbon straight-filament lamps and Frink reflectors behind each panel. From the ceiling over the first balcony are hung four bowls with 250-watt lamps. In the first-floor corridor there hang five bowls with 250-watt lamps, and at the foot of the stairs are glass urns with 150-watt lamps.

The glass for the bowls, acorns and panels is the so-called "Parian" ware. Frink reflectors are used over the ticket window, around the inner edge of the marquise, and inside the framework of the billboards in front. The fixtures for this installation were furnished by the H. W. Johns-Manville Company, New York.

Diesel Engines

Four-cycle Diesel engines with ratings of from 40 hp to 1000 hp and two-cycle engines of the same type with ratings up to 3000 hp are being placed on the market by

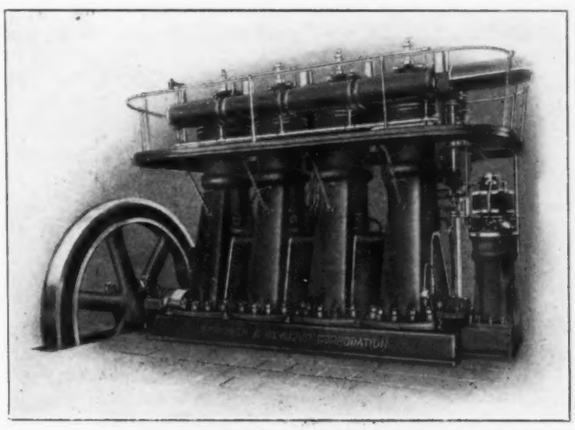


FIG. 1—FOUR-CYCLE, 500-HP DIESEL ENGINE

the McIntosh & Seymour Corporation, Auburn, N. Y. These engines are being built according to designs worked out by the Swedish Diesel Engine Company, Stockholm, Sweden. All the stationary engines, including special high-speed four-cycle engines, are suitable for direct connection to electric generators. The speeds in general are lower than those used with directly driven generators in Europe. One of the chief characteristics of these "Swedish" Diesel engines, the

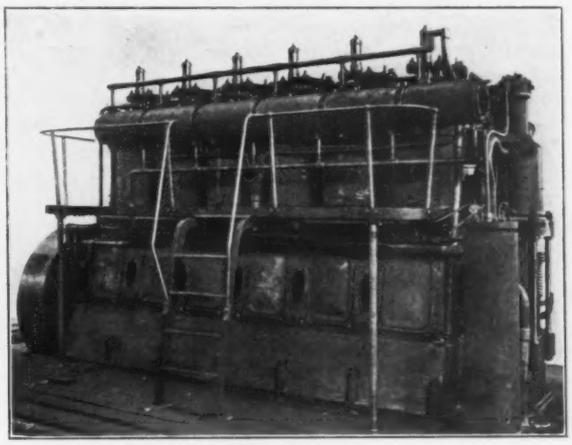
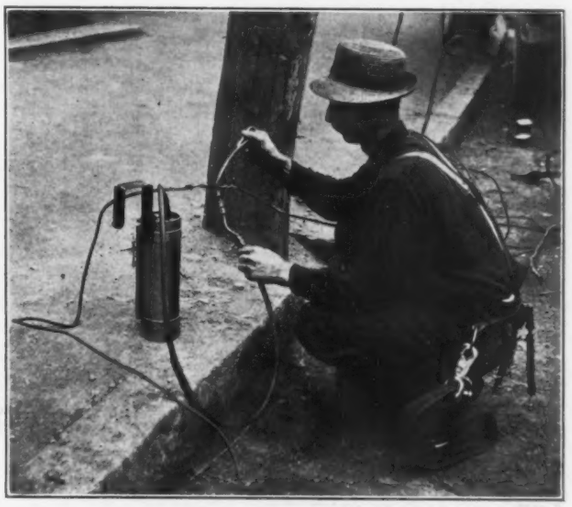


FIG. 2—STATIONARY ENGINE WITH SINGLE-BOX FRAME

manufacturers claim, is their freedom from cylinder wear together with their low consumption of cylinder-lubricating oil. Both the individual A-frame for each cylinder and the single-box type of frame for the entire unit are used. In Fig. 1 is shown a four-cycle, 500-hp stationary engine with individual frames for each cylinder. In Fig. 2 is shown a stationary engine with a single-box frame for the entire unit. Both types are equipped with directly connected multiple-stage air compressors for fuel injection.

Acetylene Torch for Soldering Connections

An improved method of soldering connections has been in use by the Quincy (Mass.) Electric Light & Power Company during the past three months, involving the practical abandonment of the gasoline torch and the use in its place of the torch and tank manufactured by the Prest-O-Lite Company,



ACETYLENE TORCH FOR SOLDERING CONNECTIONS

Indianapolis, Ind. As shown, the equipment consists of a tank and torch, to which the company, at the suggestion of its superintendent, Mr. F. W. Austin, has added an oak handle, 9 in. long and 1⅛ in. in

diameter, and a pole clamp of inverted U-shape which greatly facilitates hanging the tank upon cross-arms when in the field. A rubber hose 4 ft. long and ¼ in. inside diameter was also added by the company. The clamp is composed of three straight pieces, 6 in., 3½ in. and 4 in. long and 1¾ in. wide, the stock being ⅛ in. thick, and is riveted at four points to a cylindrical clamp provided by the Prest-O-Lite Company. The handle is clamped into the latter and held by wing nuts. The tank is 13 in. over all and 4 in. in diameter and contains acetylene gas under pressure. There is a gage at one end reading up to 250 lb. per sq. in. maximum, and a needle valve is provided in the outlet pipe at the other end. Six small holes in the head of the burner provide ingress of air. The torch can be lighted with a match and used without the slightest delay whenever the valve is opened.

The company has found that these torches save much time in soldering as compared with the gasoline outfit commonly employed, and that they are cheaper initially, as well as less expensive to recharge. A first-class gasoline torch costs about $14, and the burner, if constantly used, must be replaced every three months or thereabouts by a new outfit costing about $7.50. The present cost of the cylinders approximates $10, the burners costing about 75 cents each in addition. It is probable that the complete outfit can be marketed for less than the cost of a gasoline torch. Recharging costs 50 cents per cylinder, and this has to be done about every ten days to two weeks.

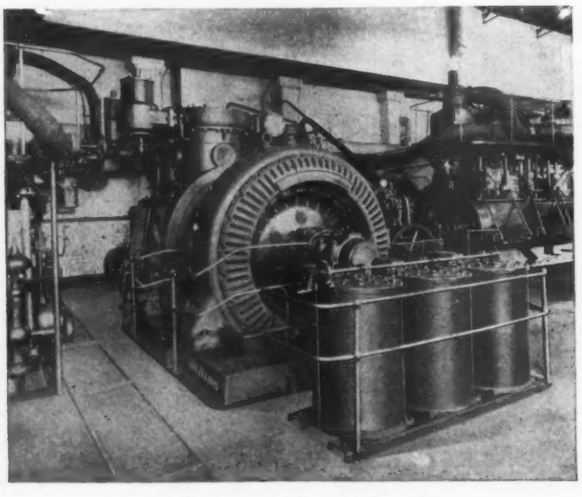
In the field the flame of the torch is smaller than with the gasoline outfit; the amount of solder melted is correspondingly less for a given joint, and there is much less trouble from burning off paint and varnish on adjacent woodwork than with the gasoline equipment, whose large-sized flame is at times awkward. In using the Prest-O-Lite torch the ground-man merely attaches a rope to the device; then the torch is quickly hauled into place and hung on the cross-arm, and is instantly ready for service, without interruptions due to weather conditions. These torches are used in the power plant of the company and in soldering customers' services, as well as for general line construction and maintenance.

Electrically Driven Air Compressors in Large Shipyard

The large motor-driven air compressor shown in the accompanying illustration is installed in an important shipbuilding plant in England. The machine itself is of the two-stage inclosed type and includes an intercooler. Each line of parts comprises in itself a two-stage compressor, so that if desired the machine can deliver its full capacity of 2000 cu. ft. of air per minute, or any portion of it, when driven at a constant speed of 235 r.p.m. Forced lubrication is used throughout for all bearings.

The motor is started by a bank of oil-immersed starters shown in the foreground of the illustration. A main oil switch and the necessary instruments are mounted on a small panel.

The compressor was built by Alley & McLellan, Ltd., Glasgow, Scotland, and is driven by a 360-hp induction motor operating on 440-volt, three-phase, forty-cycle energy. The General Electric Company, Ltd., of Witton, Birmingham, England, manufactured the motor and switch gear for this installation.



MOTOR-DRIVEN AIR COMPRESSOR

Steel-Shell Drawing Press

The drawing press shown herewith was recently built by the E. W. Bliss Company, Brooklyn, N. Y., and is said to be one of the largest presses of its kind in the world. The machine has an over-all height of 40 ft. and weighs approximately 650,000 lb. Large vertical steel rods are employed to take the working strain. This press is designed to draw steel shells as large as 48 in. in diameter. It will draw and lift out shells as deep as 40 in. and draw and push through shells 45 in. deep. Blanks as large as 64 in. in diameter and 3/16 in. thick can also be drawn.

The table carrying the die is operated by a powerful toggle mechanism which connects to two crank pins on the main gears. The plunger carrying the punch is operated by a steel crosshead which is connected by two double connecting rods to the crank pins on the main gears. The blank holder is stationary. The plunger and blank-holder adjustments are made by means of electric motors, a separate motor being used for each adjustment. Before adjusting, the blankholder is unlocked, and after adjusting it is locked by an electric motor. All motors for adjusting are directly attached to the machine.

The entire train of gearing is of steel with machine-cut teeth. The machine has three ratios of gearing—200 to 1, 100 to 1 and 67 to 1. By means of change gears, the speed of operation may be varied from 1.5 r.p.m. to 3 r.p.m. and 4.5 r.p.m. as required for the different classes of work. The crosshead and bed are counterbalanced by a hydraulic accumulator which may

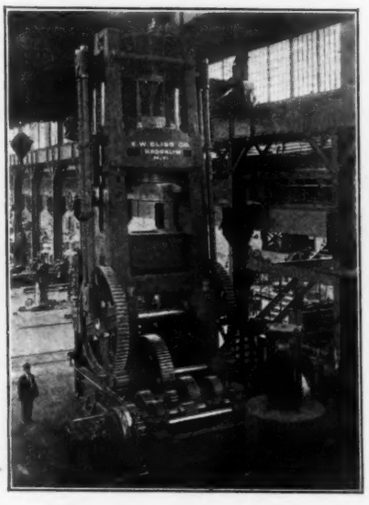


FIG. 1—REAR VIEW OF PRESS, SHOWING GEARS

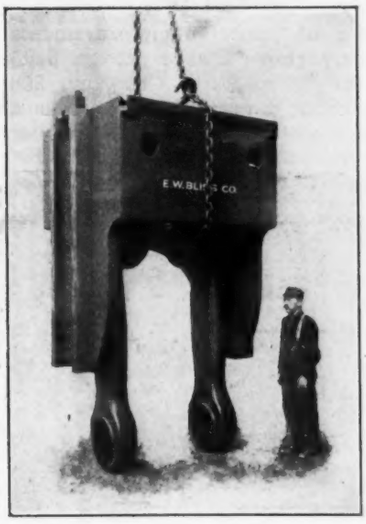
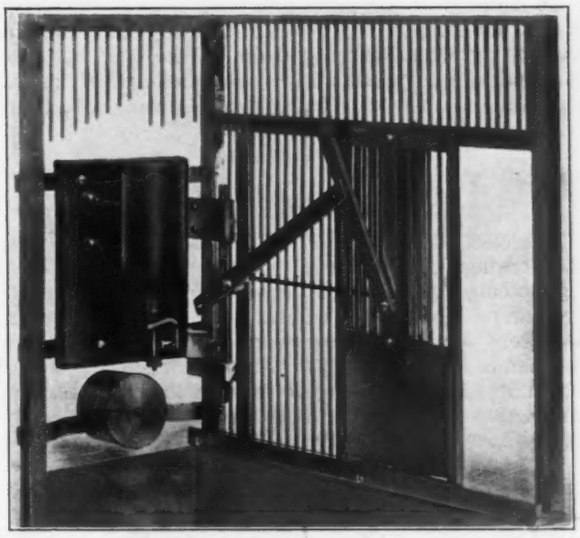


FIG. 2—DIE TABLE AND TWO CONNECTING LINKS

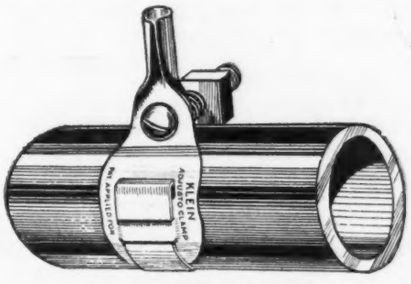


ELEVATOR SHAFT EQUIPPED WITH ELECTRIC GATE LOCK

be placed above or below the floor line in any suitable place near by. The machine is driven by a 200-hp motor and is controlled by a hand-operated friction clutch of the double-grip type.

Ground Clamp

The ground clamp shown in the accompanying illustration is made of solid copper and is designed for use with any size of pipe, armored cable or metal molding.



COPPER GROUND CLAMP

It is installed by bringing the end around the pipe and adjusting the bolt; then the free end of the slide is pulled around until it just bands the pipe. The surplus of the slide is next bent back and finally the clamp is fitted snugly against the pipe by tightening the screw.

S. Robert Schwartz & Company, 624 Broadway, New York, are the general sales agents for this ground clamp.

Electric Gate Lock for Elevators

An electrically operated mechanism for locking gates opening onto elevator shafts, and which prevents any gate being opened except when the elevator floor is within three inches of the proper stopping position, is being manufactured by the Safety Appliance Company, St. Louis, Mo. The device consists of a small solenoid to the plunger of which is attached a pawl engaging with a slotted vertical rod which must be free to move before the gate can be opened. The entire mechanism, including the operating switch, is installed on the shaft wall at each landing. To open the gate the car must be within 3 in. of the landing when a mechanical floor trip closes the electrical contact on the shaft wall. An auxiliary switch is furnished with the apparatus so that the doors can be opened in an emergency if the car is stopped between floors.

Lighting and Dimming Switch for Automobile Lamps

A lighting and dimming switch for use on automobiles, cycle-cars, motorcycles, etc., is being made by the Connecticut Electric Manufacturing Company, Bridgeport, Conn. The contacts are inclosed in a two-part receptacle of black composition. The handle can be placed in three different positions. The accompanying diagram shows one method of connecting the lamps of an automobile to the switch. With the handle in position No. 1 the head-lamps are off and the side and tail-lamps are on; in position No. 2 all lamps are off; in position No. 3 the side-lamps are off and the head-

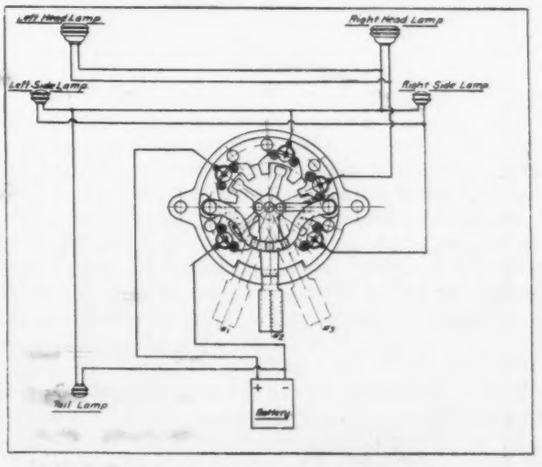


DIAGRAM OF CONNECTIONS

lamps and tail-lamps are on. By changing the connections the following arrangement can be obtained: With the handle in position No. 1, the head-lamps are dim and the side-lamps and tail-lamps are bright; in position No. 2, all lamps are off, and in position No. 3, all the lamps are bright. When no side-lamps are used the following combination can be had: Position No. 1,

head-lamps dim, tail-lamp bright; No. 2, all lamps off; No. 3, all lamps bright. This lighting and dimming switch, the manufacturers claim, is the only switch of its kind on the market with one handle which can be manipulated so as to obtain three lighting effects.

Electric Hand Drier

The electric hand drier illustrated herewith consists of a casing mounted on a "sanitary" base with 12-in. legs, occupying an area 11 in. by 13 in. An opening is provided at the top, as shown, with suitable ducts and deflectors for distributing warm air to all portions of the hands. A foot pedal closes a quick-acting switch which puts in operation a blower that forces air through an electric heating element to the ducts and deflectors.

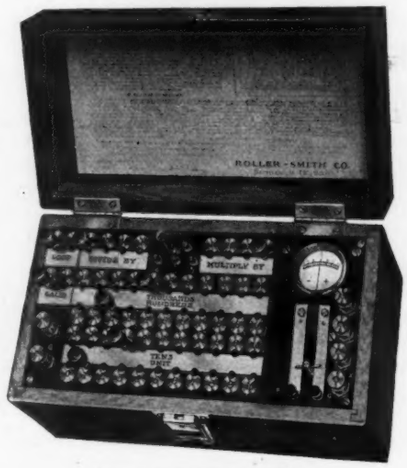
The device is particularly adapted for use in lava-

ELECTRIC HAND-DRYING APPARATUS

tories and surgical and dental operating rooms for quickly drying the hands after washing. In many factories and other places where large forces are employed the washrooms are equipped with roller towels, which, of course, are very unsanitary. Roller towels have been superseded to some extent by absorbent paper towels, although the initial expense and the cost of an attendant for keeping the washrooms supplied and removing the soiled and wet paper towels are rather burdensome. This electric hand drier is designed to take the place of the towels. This hand drier is perfectly sanitary, for it is unnecessary to touch any part of the device with the hands. It is put in operation by a pressure of the foot on a pedal, and the operation is discontinued by removing the foot. The hands can be thoroughly dried, it is declared, in from thirty to forty seconds, which is less time than is required to dry the hands with the same thoroughness with linen or paper towels. For each operation 11 watt-hours are taken on an average. This electric hand-drying device has been designed by Mr. J. M. Ward, office of superintendent of the District Building, Washington, D. C.

Portable Test Bridge

A number of important improvements have been made in the portable decade pattern bridge manufactured by the Roller-Smith Company, 203 Broadway, New York City. Chloride-of-silver cells are now employed, and these are so arranged that any one or all



PORTABLE TEST BRIDGE

of them may be used. Provision is also made for the use of external cells if desired. The galvanometer has been so improved that its sensibility is now about 300,000 ohms, and a large opening for the scale enables readings to be taken quickly. External galvanometer terminals are also provided. The two contact keys are independent but are placed side by side so that they may be separately or simultaneously operated as desired. An externally operated zero adjuster is now provided with each set.

Ornamental Street-Lighting Unit

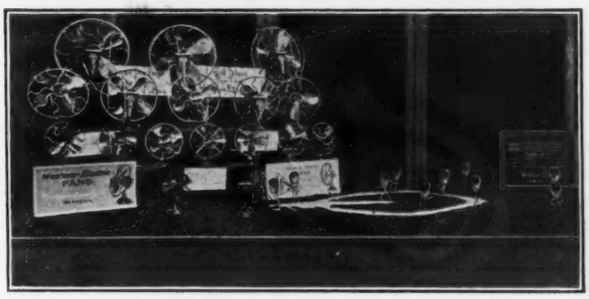
New fixtures for ornamental street-lighting, designed for operation with both series and multiple circuits and with high-efficiency incandescent lamps, are being made by the General Electric Company, Schenectady, N. Y. There are two styles of these units, the only difference between the two being in the glassware equipment.

The glassware in one style consists of a medium alabaster globe which is so shaped that some of the light can pass upward and illuminate the building fronts. A small reflector is placed at the top inside the globe. The function of this reflector is to direct downward and make useful the light that would otherwise be lost in the bottom of the ventilator surmounting the globe. The other style of unit has a two-piece globe. The bottom part is made of crystal glass, rough inside, while the top is of "Pyro" glass. No reflector is used, as the top is made of dense glass with the inside glazed, thereby reflecting some of the light downward, although enough is filtered through to illuminate building fronts. Air enters the lamp chamber through small holes in the globe and leaves through concealed openings in the spun-copper ventilator at the top. A compensator is mounted inside the ornamental casing.

Jobber, Dealer and Contractor

Baseball "Fans"

The accompanying picture shows a tungsten-lamp ball game with a grandstand of electric "fans" to applaud the players, as exhibited in the window display of the Cincinnati distributing house of the Western



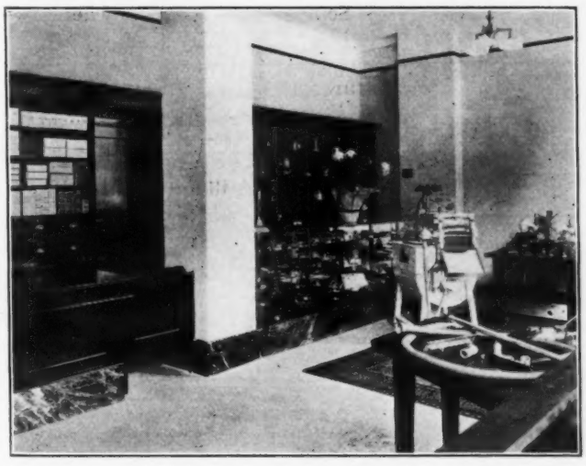
DISPLAY OF BASEBALL "FANS" IN CINCINNATI DEALER'S WINDOW

Electric Company. By a flasher arrangement each "player" lights up as he receives the "ball," and the fans are connected so as to applaud each "out." A description of a similar display in Louisville, Ky., was given in the *Electrical World* of June 14 and 28, 1913.

Chicago Contractors Branching Out

Another evidence of the "forward movement"—if such it may be called—among electrical contractors all over the country is shown by the removal of the well-known Freeman-Sweet Company, of Chicago, from an upstairs location in the building at 538 South Dearborn Street, to the storeroom at 602 South Dearborn Street illustrated herewith. In this store, which has been attractively fitted up, the company displays a wide variety of electrical goods offered for sale.

Above the store on the second floor of the Transportation Building are the general offices of the com-



INTERIOR VIEW OF NEW STORE OF FREEMAN-SWEET COMPANY, CHICAGO

pany, with private offices for Mr. Ernest Freeman and Mr. Frank Z. Sweet. There are also a drafting room, consulting rooms and all the equipment needed for an up-to-date engineering and contracting business. The Freeman-Sweet Company is progressive, and on its walls it displays certificates of membership in the Society for Electrical Development and the National Electrical Contractors' Association of the United States. Mr. Freeman is president of the latter organization.

Executive Committee for Electrical Development in Chicago

At a meeting of the general Chicago committee of the Society for Electrical Development held at the Hotel Sherman on June 30 to meet Mr. George B. Muldaur, the field co-operator of the society, it was decided to appoint an executive committee of four to carry forward the work of the society in Chicago. This executive committee was constituted as follows: Mr. Ernest Freeman, president of the Freeman-Sweet Company, representing the electrical contractors; Mr. John F. Gilchrist, vice-president Commonwealth Edison Company, representing the central-station interests; Mr. W. W. Low, president Electric Appliance Company, representing the jobbers, and Mr. T. P. Gaylord, district manager for the Westinghouse Electric & Manufacturing Company, representing the manufacturers. Mr. Muldaur gave an outline of what has already been accomplished and of the work laid out to further the aims and objects of the society.

Credit Given to Receivers Appointed by Court Only at Risk of Creditor

The important case of Miller vs. American Light & Fixture Company, decided recently in the Appellate Court of Illinois, is of particular interest to electrical credit men. As a petition for an appeal was made to the Supreme Court and there denied, the appellate decision may be taken as having the sanction of the highest court in that State.

In its opinion the court acknowledged, as the counsel had likewise, that no case had been found exactly in point for the decision. However, there were questions involved which had been repeatedly decided in this and other courts and as to which credit men generally are uninformed. In fact, a credit man would assume, as a rule, that whatever credit was asked by any receiver operating a business appointed under order of a court of equity should be granted without hesitation. The contrary, however, is the rule upon which the credit man should act upon such a request. As held in the decision cited, one deals at his peril who extends credit to a receiver, though appointed and authorized to act under order of court. For the court under ordinary circumstances has no responsibility and is not surety for the debts of the receiver, though authorized, nor are the parties to the litigation, nor the receiver, personally liable beyond the assets actually in his possession and control as receiver.

It is advisable, therefore, if doubt exist, that the property in the hands of the receiver be looked into by the prospective creditor before credit is extended by him to the receiver under any circumstances. For, as a rule, unless the property itself of which the receiver has good title proves sufficient upon liquidation to pay all the debts incurred by the receiver in his receivership, including his fees and expenses, the deficit is lost by the trusting creditors. The mere fact that the property in the hands of the receiver is insufficient to meet the expenses of the receivership, the court has affirmed repeatedly, does not render the complainant or person commencing the proceedings, and who had the receiver appointed, liable for such expenses. This risk is that of the creditors.

Co-operating with Contractors at Muncie, Ind.

Enlisting the co-operative efforts of six of the city's representative electrical contractors, the Muncie Electric Light Company recently inaugurated a deferred-payment wiring compaign which promises to be quite successful. In addition to giving the owners of small homes a chance to secure electric service at a low rate, the campaign has brought the electrical contractors and central-station interests closer together than ever before.

Before beginning the campaign, Mr. Thomas F. English, manager of the lighting company, called a conference of the contractors. Among the firms which responded were Boone & Smith, the Electrical Construction & Supply Company, the Ideal Electric Shop, the Kimbrough Hardware Company, the Nutting Electric Company and Wise & Clark. These contractors fixed the wiring schedule as shown in the accompanying table and agreed that the lighting company should receive 10 per cent of the gross cost of wiring for handling each contract. The accompanying schedule shows the prices for jobs ranging from three outlets to nine outlets. When more than nine outlets are required on any one job, $1.57 is added to the contractor's price and $1.70 to the company's price for each outlet above nine.

SCHEDULE OF HOUSE-WIRING PRICES, MUNCIE, IND.

Wiring Prices			Switch Prices		
Outlets	Contractor's Price	Company Price	Type	Contractor's Price	Company Price
3	$9.00	$9.90	Single-pole snap	$1.25	$1.40
4	10.85	11.95	Flush switch	1.75	1.95
5	12.66	13.90	Cellar outlet, complete with switch	2.00	2.20
6	14.43	15.90	Porch outlet, complete with flush switch	2.50	2.75
7	16.06	17.70	Porch outlet, complete with snap	2.25	2.50
8	17.91	19.70	Three-point push, flush	5.00	5.50
9	19.75	21.70	Three-point snap	4.50	5.00

CUSTOMERS' PAYMENT.

Houses of	Cash Payment	Monthly Payment
Three rooms	$1.98	$0.79
Four rooms	2.39	0.96
Five rooms	2.78	1.11
Six rooms	3.18	1.27
Seven rooms	8.54	1.42
Eight rooms	3.94	1.58
Nine rooms	4.34	1.74
Ten rooms	4.68	1.87
Eleven rooms	5.02	2.01
Twelve rooms	5.36	2.14

Although these prices are designed to cover installations of drop-cords and sockets, they also apply to the charge for hanging fixtures where the customer decides to use fixtures. Upon the completion of the work, and following the city inspection, contractors are paid in full by the lighting company. The customer then pays the company 20 per cent of the amount of the bill in cash and the remainder in ten equal monthly payments. In special cases this time may be extended even longer.

Mr. Roy Thurman, new-business manager for the electric-service company, has full charge of giving out contracts, and ordinarily these are rotated regardless of their size. In order to facilitate the work of contractors, however, the lighting company may award a number of contracts in any part of town to one particular contractor, and he, having a number of contracts in the same vicinity, is spared the expense of re-hauling tools and material. The limit of the number of contracts to be awarded in any group is ten. After one wiring firm has received several contracts in one vicinity, it is not awarded any additional contracts until the other co-operating firms have received an equal number.

Mr. English says that the owners of even the smallest homes in Muncie are taking advantage of this offer and that some of the new electric-service customers live in buildings which almost rival those described by Mr. S. E. Doane in his recent paper "Handling the Small Consumer in Europe," published in the *Electrical World* May 23. Although the ratio of population to consumers in Muncie is approximately six to one, forty-five contracts were secured under this plan during the first month of its operation. The contractors all express themselves as very much pleased with the scheme, and each one is working in hearty accord with the electric-service company. In addition to the forty-five contracts secured by the lighting company's solicitors, wiring firms report that the general publicity has increased their regular business.

A Convenient Table for Electrical Contractors

To assist in laying out a wiring installation so that the potential drop within the premises will be less than 1 volt, Mr. M. D. Cooper, of the engineering department of the National Lamp Works, Cleveland, Ohio, recently presented the accompanying table before the annual convention of the Electrical Contractors' Association of Indiana. This table shows at a glance the current values which circuits of various sizes of wire and of various lengths will carry without exceeding the allowable 1-volt drop. The first jagged line at the left of the table denotes the limit of allowable carrying capacity given in the Underwriters' code. The second jagged line denotes the limit of current (6 amp) prescribed at 110 volts by the 660-watt-per-circuit rule.

Suppose, for instance, explained Mr. Cooper, that it is desired to install a lighting circuit 80 ft. in length. Following down the column headed "80" it is seen that with No. 14 wire a current of 2.5 amp gives a drop of 1 volt; with No. 12 wire 3.9 amp will produce a drop of 1 volt, and with No. 10 wire it takes 6.3 amp to produce a similar drop. If a 660-watt load is connected to the circuit the current at 110 volts will be 6 amp, hence No. 10 wire should be used to keep the potential drop within the desired limits.

Allowable Amperes for 1 Volt Drop

Size of Wire B. & S.	LENGTH OF CIRCUIT IN FEET (Length of Wire Twice as Great)																
	10	20	30	40	50	60	100	120	150	175	200	250	300	350	400	450	500
10	8.3	6.3	4.2	3.1	2.1	1.6	1.2	1.0	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.3	0.2
14	13	9.9	6.6	5.0	3.3	2.5	2.0	1.6	1.3	1.1	1.0	0.8	0.7	0.6	0.5	0.4	0.4
12	21	16	10	7.8	5.3	3.9	3.1	2.5	2.1	1.8	1.6	1.3	1.1	0.9	0.8	0.7	0.6
10	33	24	17	13	8.3	6.3	5.0	4.0	3.3	2.9	2.5	2.0	1.7	1.4	1.3	1.1	1.0
8	53	40	27	20	13	10	8.0	6.4	5.3	4.6	4.0	3.2	2.7	2.3	2.0	1.8	1.6
6	84	63	42	32	21	16	13	10	8.5	7.2	6.3	5.1	4.2	3.6	3.2	2.8	2.5
4	134	101	67	50	34	25	20	16	13	12	10	8.1	6.7	5.8	5.0	4.5	4.0
3	169	127	84	63	42	32	25	20	17	15	13	10	8.5	7.2	6.3	5.6	5.1
2	216	160	107	80	53	40	32	26	21	18	16	13	11	9.2	8.0	7.1	6.4
1	268	201	134	101	67	50	40	32	27	23	20	16	13	12	10	9.0	8.1
0	340	254	167	128	85	64	51	41	34	29	25	20	17	15	13	11	10
	Prohibited by "allowable current carrying capacity" rule				Prohibited by "660 watts per circuit" rule												

TABLE FOR ELECTRICAL CONTRACTORS

Inasmuch as central stations' voltage tests are generally made at service entrance, it is important that the voltage drop between the entrance and the lamps should be kept as low as possible.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Plant for New Porcelain Insulator Company.—Work is to begin at once at Youngstown, Ohio, on the plant of the Newby Process Insulator Company, recently organized for the purpose of manufacturing porcelain insulators and similar goods. The company has taken over the Newby Manufacturing Company, and increased the capital stock from $10,000 to $500,000.

Addition to Ontario Generating Station.—The Kaministiquia Power Company, Fort William, Ontario, has commenced installing an extra unit of 12,000-hp rating in its plant. This new unit has almost double the rating of any one of the three units totaling 22,000 hp that are now in operation. Some 350 men are now working on the building of the new aqueduct at Kakabeka.

Small Variable-Speed Motors Selling Well.—The business of the Kimble Electric Company, Chicago, for June, 1913, broke all previous records, but with the recent closing of the company's books for June, 1914, it has been found that the preceding year's record business was practically duplicated. Thus far, says Mr. J. K. Bass, general manager of the company, the business for 1914 has been good. The books show that the sales for this year are 15 per cent ahead of what they were for the corresponding six months of last year. The company's principal product is variable-speed motors.

Distillery Uses Central Station Energy During Summer.—The Louisville (Ky.) Gas & Electric Company, through Mr. Robert Montgomery, manager of the commercial department, has contracted with the Sunnybrook Distillery Company of Louisville to supply its lighting load during the summer months when the plant of the distilling company is closed down. A motor-generator set renders the alternating-current service of the central station available for use by the distillery motors. Mr. Montgomery is negotiating with other local distilleries to supply the same sort of service.

Electric Heating Business Soaring.—Fourteen thousand square feet of additional space has just been rented by the Hughes Electric Heating Company in Chicago, in order to care for its rapidly growing business. With this additional floor space the company has now increased the size of its Chicago quarters 200 per cent during the past year. Growth in the Canadian factory of the company has likewise been rapid. Negotiations are now under way for the construction of a new building to be owned by the Hughes Electric Heating Company, and it is thought that the factory will be moved about Jan. 1, 1915. The company now employs 150 men.

Diesel-Engine Set at San Francisco Exposition.—A four-cylinder, 500-brake-hp Diesel oil engine built by the Busch-Sulzer Brothers Diesel Engine Company, St. Louis, Mo., is being installed in the center of the Palace of Machinery of the Panama-Pacific Universal Exposition, San Francisco, Cal. It was the first exhibit to be erected on the grounds, the foundation having been started on May 27. The engine will be directly connected to a direct-current generator which will operate in parallel with the electric-service system on the exposition grounds. The cylinders of the oil engine each measure 19.5 in. by 24 in. Both the cylinders and the exhaust manifold and piping are water-jacketed, thus affording maximum recovery of heat. The engine has a thermal efficiency of about 35 per cent. Approximately 48 per cent of the heat not converted into useful power is recovered in the cooling water.

Long Life for High-Tension Rectifier Tubes.—In the report of the People's Gas & Electric Company, Savanna, Ill., recently issued, it is stated that the average life of the mercury rectifier bulbs used on its constant-current arc-lighting circuits for the last three years is 8398 hours, although they were guaranteed for an average life of only 500 hours. It should be noted that this life is not the individual life of bulbs but the average; some bulbs still in service have been operating in the neighborhood of 9000 hours. Mr. T. P. Bowen, manager of this company's plant, attributes this extra long life to the fact that the bulbs are operated, according to the instructions of the manufacturers, the Westinghouse company, on short-circuit for four or five minutes each night before throwing on the lamps. In addition to this treatment, the bulbs are occasionally taken from the tank and "rested" for a week or more and are also occasionally given hot-water baths.

American Efficiency Survey of Motor-Car Units.—An organization bearing the name "American Efficiency Survey of Motor Car Units" has come into existence, and, it is said, expects to announce itself soon in national advertising mediums as formed for "testing and proving the units which go to make up a motor car." It is said that this movement is the first step in an effort to establish independent disinterested standards of efficiency in the automobile industry, which in point of capital invested is second only to the steel industry in this country. Tests of the units of various manufacturers are to be conducted in the laboratories at Purdue University under the guidance of Profs. C. S. Benjamin, dean of the engineering schools; Louis E. Endsley, G. A. Young, M. J. Golden, C. Francis Harding and Robert G. Pilkington. According to the plans as announced, tests of all units are to be made, and after a comparison of results a silver trophy will be awarded to the manufacturer whose apparatus proves best. The manufacturer will also be allowed to use the insignia of the American Efficiency Survey in his advertising. Letter heads issued by the new concern bear the names of Messrs. Harry Newman, president; Kenyon W. Mix, vice-president; David Minard Shaw, vice-president and secretary, and Charles S. Castle, treasurer. The office of the American Efficiency Survey of Motor Car Units is at 30 North Michigan Boulevard, Chicago, Ill.

Orders for Electrical Equipment.—The following important orders have been received recently by the Westinghouse Electric & Manufacturing Company: The Charleston & Interurban Railway Company, Charleston, W. Va., one 300-kw rotary converter, three 110-kva transformers and one switchboard; the Atlantic Shore Railway Company, Kennebunk, Maine, one 300-kw rotary converter; the Benton Harbor & St. Joe Railway & Light Company, Benton Harbor, Mich., one 300-kw rotary converter; the United Gas & Electric Engineering Corporation, Baltimore, Md., threo 1000-kw rotary converters; the Pacific Gas & Electric Company, San Francisco, Cal., one 1000-kw rotary converter, five 1000-kw generators, each on common base with five 1440-hp synchronous motors; the Jamestown, Westfield & Northwestern Railway Company, Jamestown, N. Y., one complete portable substation consisting of one 500-kw rotary converter, one 550-kva outdoor-type transformer, one two-panel switchboard and one substation car; the St. Paul Southern Electric Railway Company, St. Paul, Minn., one 300-kw rotary converter, three 100-kva transformers and one switchboard; the Philadelphia Rapid Transit Company, Philadelphia, Pa., two 3000-kw rotary converters and six 1100-kva transformers; the Northwestern Electric Company, Portland, Ore., one 75-kw generator on common base with an induction motor, and a switchboard; the Moir Hotel Company, Chicago, Ill., one 200-kw generator and two 400-kw generators; A. J. Anderson & Company (Tuberculosis Hospital), Louisville, Ky., one 75-kw generator and a switchboard.

Electric Ambulance Popular with Physicians.—Preference is being shown, it is reported, by many physicians in Louisville, Ky., for the Waverly electric ambulance of the Louisville Carriage & Taxicab Company. This vehicle is the only electric car of its type in the city, the others being gasoline-driven. The electric vehicle is considered especially preferable because of its easy control and smooth running and the impossibility of the driver jostling the patient unduly, however excited he may get.

Orders for Hydraulic Turbines and Accessories.—The I. P. Morris Company, Philadelphia, Pa., recently secured an order from the Turners Falls Company, Turners Falls, Mass., for three governor mechanisms and a central pumping system to be applied to three 9700-hp waterwheel units, the contract for which was received by the above company in October, 1913. This company has also been awarded contracts for the following equipment: The Columbia Mills, Inc., Minetto, N. Y., six 2200-hp vertical-shaft, single-runner turbines, designed to operate at a speed of 68.2 r.p.m. under a head of 17.5 ft., six governors and a central pumping system; the Canadian Light & Power Company, St. Timothée, Quebec, Canada, three 7200-hp horizontal-shaft, double-scroll-casing units, designed to operate at a speed of 150 r.p.m. under a head of 48 ft., and three governors. The latter order supplements an order for one unit of the same rating as those enumerated, which was placed with the I. P. Morris Company in February.

Electrical Apparatus for Industrial Concerns.—Indicative of activity in the industrial field and the increasing use of electrical apparatus, the following important orders recently received by the General Electric Company are of interest: Phillips Insulated Wire Company, Darlington, R. I., two 750-kva Curtis turbo-generators with a 17.5-kw exciter set, regulator equipment and switchboard; the Buffalo, Rochester & Pittsburgh Railway Company, Dubois, Pa., a 525-kva Curtis turbo-generator, a 400-kw motor-generator set, a 75-kva alternator, two 3-kw exciters, two 37.5-kva transformers and switchboard; the Apsley Rubber Company, Hudson, Mass., a 400-hp induction motor, 50-kva transformer and starting panel; the Husted Milling Company, Buffalo, N. Y., one 15-kva and two 200-kva transformers, and twenty-six motors ranging in rating from 5 hp to 100 hp; the American Optical Company, Southbridge, Mass., a 1250-kva, 3600-r.p.m., 600-volt Curtis turbo-generator; the Nairn Linoleum Company, Newark, N. J., a 4-ton electric storage-battery industrial locomotive; the Chicago & Western Indiana Railroad, Clearing, Ill., sixty-nine motors ranging in rating from 2 hp to 50 hp; the William R. Thropp & Sons Co., Trenton, N. J., 300-hp induction motor with controller and oil-switch; the Phoenix Portland Cement Company, Nazareth, Pa., a 140-kva synchronous motor, a 150-kva alternating-current generator, two 200-kva transformers and a switchboard.

Electric Automobiles Make Long Trip.—A 135-mile trip, from Los Angeles, Cal., to Riverside, Cal., and return, was recently made by ten Beardsley electric stock machines. Two days were taken to make the journey. All ten machines, it is reported, made a 100 per cent score, notwithstanding the fact that several of the cars were operated by inexperienced drivers. One car was driven by an aged man who had secured his machine only the day before starting the tour and who had had only one lesson of an hour's duration. The drivers of three of the machines were women, and they operated their machines the entire distance without a mishap, although this was the first trip of the kind that they had ever taken in any machine. The start from Los Angeles was made at 10 o'clock Saturday morning and was in charge of Mr. John T. Shannon, electrical engineer for the Beardsley Electric Company, 1215 West Seventh Street, Los Angeles. The first stop was made in Ontario, at a distance of 44 miles from Los Angeles. In many places the roads were heavy on account of the detouring necessary because of the construction of the state highway. The supreme test of the outbound trip came when, at the end of a long journey with many grades and across the sands, the final stretch was made up the famous Rubidoux grade into Redlands. The cars were recharged at Riverside, and at 11 o'clock the following morning the return journey was begun. An hour was taken at noon for lunch. The tourists arrived in Los Angeles at 3:30 p. m. with plenty of energy remaining in the batteries. It is the intention of the Beardsley company to conduct other tours of this character throughout the summer months.

Electrically Equipped Mine at San Francisco Exposition.—The United States Bureau of Mines has undertaken to construct, in co-operation with the mining industry and the manufacturers of mining machinery, an actual operating mine beneath the floor of the Palace of Mines and Metallurgy at the Panama-Pacific Exposition, to be held at San Francisco next year. Coal-mining operations will be reproduced by full-size workings in which mining machinery will be installed and operated. The walls of the mine will be covered with ore or coal typical of the mine illustrated. A number of mining companies have agreed to reproduce some of their stopes and to contribute the sum necessary to installation and operation of the exhibit. Mining machinery and appliances have been promised, including a mine cage and cars by the Joshua Hendy Company, a cage, hoist and motor by the Denver Engineering Works, locomotives by the Westinghouse Electric & Manufacturing Company, pumps by Byron Jackson, air compressor, drills, drill sharpener and winze hoist by the Compressed Air Machinery Company, drills and coal cutters by the Ingersoll-Rand Company and the Sullivan Machinery Company, lamps by the Justrite Manufacturing Company and the Koehler Manufacturing Company, etc. There is little doubt that other necessary machinery and appliances, such as safety lamps, portable electric lamps, fans, mine telephones, mine rescue apparatus, switches, track, etc., will be received as exhibits. The entrance to the mine will be through the Bureau of Mines space. Visitors will be attracted to it by being given portable mine lamps and by being lowered in a very slowly moving cage while a panoramic effect of the strata lining a mine shaft will pass by them so rapidly as to produce the illusion of descending to a considerable depth.

Model Electric Home for Panama-Pacific Exposition.—An attractive feature of the General Electric Company's exhibit at the Panama-Pacific Exposition will be an electrical home. Every practicable electrically operated labor-saving device suitable for use about the household will be shown in actual service. The "home electrical" will be a full-sized house, consisting of a living-room, dining-room, breakfast room, bedroom, bath, kitchen, laundry and sewing-room. Nearby will be the electrical garage, workshop, creamery, etc. The kitchen will be provided with an electric range for all cooking purposes, and with electrically driven machines for peeling vegetables, polishing silver, freezing ice-cream, driving cake and dough mixers, and doing other necessary work. In the electric laundry the clothes will be washed by means of electricity and ironed with electric flatirons. An adjoining room will have an electric refrigerating plant of household size for preserving foodstuffs and making artificial ice. The dining-room will be arranged to show how light lunches and suppers can be cooked with the electric chafing dish or the electric grill. The sewing-room will be equipped with a motor-driven sewing machine, a small fan and an electric pressing iron. Even the bedroom will have its modern electrical appliances—a small fan, electric lamps, a heating pad and a milk warmer. In connection with this electrical home, and as a part of the exhibit, there will also be shown a garage with an electric runabout, battery-charging outfit, etc. Adjoining the garage there is to be a small workship, completely equipped with electrically driven tools. A model dairy room with cream separator, churn, bottle washers, pumps and other small motor-driven machines such as are used almost daily on every country place will also be exhibited.

Central-Station Business on the Pacific Coast.—Central-station statistics for April received from the larger central-station companies on the Pacific Coast indicate a better rate of increase over 1913 than that indicated by the March returns. This result is entirely in line with the reports from every other section of the country, and it would seem that, satisfactory as was the March showing, the percentage rate of increase of this year's business over last year's is somewhat better than was indicated solely by the March returns. A good idea of general conditions in the Pacific States can be obtained from a scrutiny of the operating data of the Pacific Gas & Electric Company, the

Southern California Edison Company and the Puget Sound Traction, Light & Power Company. Whereas for March the combined gross income of these three companies was only 2.6 per cent in excess of 1913—$2,480,837 against $2,418,522—April's showing is more satisfactory, and the combined total is found to stand at $2,490,528 against $2,387,381—an increase of 4.3 per cent. It is practically certain that if the segregated figures for electric sales could be obtained a rate of over 5 per cent increase would be shown. The great San Francisco system, for instance, derives only one-half of its total revenue from the sale of electricity for lighting and motor service, the balance accruing from gas, water and railway service. The *Electrical World* has received April data from two other large systems in the Pacific States, each having an energy output in excess of 13,000,000 kw-hr. a month. These companies obtained an increase of 6 per cent in energy sales and 8.5 per cent in output. The station output of the Pacific Gas & Electric Company is known to be over 50,000,000 kw-hr. a month and the output of the Los Angeles and Seattle companies can also be estimated pretty closely, so that 116,000,000 kw-hr. may be taken as the combined station output of these five Pacific companies for April, 1913. This is somewhat in excess of 60 per cent of the entire lighting and motor-service business of the Coast States, and upon this fairly representative basis the estimate may be made that the central stations on the coast in April of this year received 5 or 6 per cent more revenue from the sale of energy than in 1913. In any consideration of electrical conditions in the Pacific States, however brief, one is invariably led to the conclusion that the future will be able to take care of itself very satisfactorily, and that the present stability—and even prosperity—of the operating companies there is much more securely established than would be indicated solely by figures of present expansion. Even on the somewhat narrow basis of gross earnings, the large companies in California, Washington and Oregon may be shown to be doing, under the circumstances, fairly well; but, aside from that, it is impossible to neglect the fact that the physical properties of the companies are in magnificent shape for meeting future needs, and that for the next few years the ratio of net to gross must inevitably advance. Recently very heavy investments have been made in the properties, and the directors of the companies have had a difficult task in providing the necessary amount of new capital. The financing, however, has by now been skilfully and successfully carried out, and it requires no unusual gifts of foresight to predict that, as business generally on the coast comes back to a more normal condition, and as the expansion of population and the industries are reflected in the gross income of the electrical utilities, the latter will in future be able to show an even more favorable balance-sheet than they have in the last few years. The opinion may be hazarded that at the present time the plant factor (or, in other words, the average load to generating equipment rating) is lower on the coast than anywhere in the East, and it is entirely possible that as this factor rises the large Pacific companies will be able to show some expansion statistics which will be comparable only with the wonderful record set by North and South Carolina during the last decade.

Summary of Central-Station Data for April.—The foregoing estimates of electrical growth on the Pacific Coast may be compared with those already given by the *Electrical World* for other sections of the country. The following percentages of increases, for April, 1914, over April of last year, are given as the values for (1) gross income from the sale of energy, and (2) total energy output in kilowatt-hours. The business of the electric-service utilities in the Middle Atlantic States has increased by 9.8 and 10.1 per cent; South Atlantic, 12.7 and 26.1; Central, 16 and 14; New England, 9 and 9.5, and Pacific and Mountain, 5 and 6 per cent. In this enumeration the South Atlantic States have been differentiated from the Middle Atlantic only for the purpose of emphasizing the fact that, from the standpoint of electrical growth, the South seems to be setting a faster pace than any other section of the country. The 26 per cent increase in output registered by the South Atlantic group is certainly indicative of wonderful electrical activity. The returns also indicate that there is no perceptible slackening in any of the states in the manufacturing belt, the utilities in Ohio, Michigan and Missouri particularly seeming to increase their output at a very satisfactory rate. In all, the *Electrical World* has received reports from 130 companies or groups of companies for the month of April. In the aggregate these returns show that the gross income has increased from $16,359,594 in April, 1913, to $18,027,619 in April, 1914, or at a rate of 10.2 per cent; while the total energy output has increased in the same time from 634,005,739 kw-hr. to 722,952,419 kw-hr., or at a rate of 14.1 per cent. Included in these figures are the returns from the companies operating in eighty out of the first hundred cities, and it can be accurately estimated on the basis of energy output that the data relate to about 55 per cent of the entire lighting and motor-service business of the United States. It can thus be seen that for the month there was an increase in gross income for the whole industry of nearly $3,000,000 over the same period last year. It is safe to say that, to finance this expansion, new working capital at the rate of some $15,000,000 a month is required. These figures, of course, provide direct evidence of the comparative stability of the electrical industry in times of business depression, and furnish all the explanation required for the rapid advance that is being made by public utility securities to a position of high favor in the investment market. During the first six months of this year the total corporate financing of the United States amounted to $990,000,000, divided roughly in the ratio of 52 per cent for railroads, 26 per cent for public utilities and 22 per cent for industrials. For the month of June the utilities absorbed some $49,500,000 against only $55,000,000 by all the railroad systems of the country, a great deal of this amount being for the refunding of maturing securities. There is much work to be done in driving home a realization of such facts and figures as these to the public and to the investor. To maintain the progress and to foster the growth of the electrical utilities a never-ending supply of new capital is required.

COMPARISON OF EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF ALL OPERATING COMPANIES REPORTING TO THE ELECTRICAL WORLD

	Gross Earnings from the Sale of Energy			Total Energy Output in Kilowatt-hours		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March, 84 companies	$16,891,235	$15,559,191	8.7	730,843,220	642,291,906	13.8
April, 130 companies	18,027,619	16,359,594	10.2	722,952,419	634,005,739	14.1

NEW YORK METAL MARKET PRICES

Copper	June 30 Bid	June 30 Asked	July 7 Bid	July 7 Asked
Standard spot*	.....	13.50	13.45	13.85
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	60 1 3		62 5 0	
Prime Lake	13.75 to 14.00		14.00	to 14.25
Electrolytic	13.40 to 13.50		13.70	to 13.80
Casting	13.25 to 13.35		13.55	to 13.65
Copper wire base	..... to 14.37½		14.87½	to 15.12½
Lead	3.90		3.90	
Nickel	40.00 to 45.00		40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.00 to 5.10		5.00	to 5.10
Tin, spot*	30.35 to 30.50		31.95	to 32.20
Aluminum:				
Prompt delivery	17.50 to 17.75		17.50	to 17.75
Future	17.50 to 17.75		17.50	to 17.75

*OLD METALS

Heavy copper and wire	12.00	12.25
Brass, heavy	8.25	8.50
Brass, light	7.00	7.25
Lead, heavy	3.60	3.70
Zinc, scrap	3.75	3.85

*COPPER EXPORTS

Total tons to July 7 6,403

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

The Northern Colorado Power Company.—In a letter to the holders of certificates of deposit of the Equitable Trust Company of New York, representing first-mortgage 5 per cent bonds and preferred and common stock of the Northern Colorado Power Company, Messrs. Albert M. Chambers and Albert Rothbarth, the readjustment committee, give notice that they have declared the plan for readjustment, dated July 22, 1913, effective and operative. The letter further states that the holders of all the bonds, two-year 6 per cent secured notes and secured demand notes, and more than 98.5 per cent of the stockholders, have assented to the readjustment plan.

Annual Report of the J. G. White Companies.—The annual report of the J. G. White companies was submitted as an amalgamated balance sheet of the J. G. White Engineering Corporation and of the J. G. White Management Corporation as of Dec. 31, 1913, and of J. G. White & Company as of Feb. 28, 1914. The balance sheet shows that the cash in banks, in branch offices and on hand was $553,942, and bills and accounts receivable, after making what the officers believed to be ample provision for all doubtful accounts, were $596,574, the total current assets being $1,150,516. The total debts of the company were $553,069. The companies' profits during the year were $349,070. After deducting dividends the sum of $179,938 was added to the surplus account. The last account was reduced to $159,260 by a committee of the directors, in order to make ample provision for shrinkage in value of securities due to the prevailing market conditions. Mr. J. G. White, chairman of the board of directors, stated that, in spite of the adverse business conditions, the results of the year's business of the engineering corporation and the management corporation were satisfactory. It is believed that the formation of these two companies to take over the engineering and management business, heretofore conducted as departments of the parent company, has resulted in materially increasing the efficiency of the organization and strengthening the position of the companies.

Pacific Gas & Electric Company.—The Railroad Commission of California has authorized the company to carry out its new financing plan as follows: The company may issue $5,000,000 general and refunding mortgage gold bonds, the commission to determine in a supplemental order the minimum price at which they are to be sold. The company may issue $12,500,000 of its newly created first preferred 6 per cent stock at not less than $82.50 per share and may issue as much more as may be necessary to exchange its old issue of $10,000,000 preferred stock for the new preferred stock after July 1, 1916, at the rate of ten shares of old stock for ten and one-quarter shares of new stock. Also the company may issue $1,159,800 common stock for the reimbursement of moneys expended for the retirement of bonds through sinking funds from Jan. 1, 1914, to April 30, 1914, and to provide cash for meeting certain sinking-fund payments. The proceeds from the sale of the general and refunding bonds and the first preferred stock are to be applied to the extent of $7,000,000 for the retirement of one-year notes now outstanding, to the extent of $4,586,661 for the reimbursement of the company's treasury for advances heretofore made for construction, and the balance is to be utilized for future additions and improvements. In its decision the commission complimented the company upon its plan to sell its new first preferred stock, and said: "The plan is in accord with suggestions for junior financing which have been made by this commission from time to time to various public utilities and is worthy of emulation, in so far as applicable, by other utilities."

Annual Report of the Montreal Light, Heat & Power Company.—The directors of the Montreal Light, Heat & Power Company give the following as the financial statement for the year ended April 30, 1914: Gross revenue, $6,245,697; operation and maintenance, $2,778,451; depreciation and renewal reserve, $600,000, making net revenues of $2,867,246. The fixed charges were $467,977, making a net income of $2,399,269. With $1,700,000 paid in dividends, the surplus from the year's operations amounted to $699,269. An appropriation of $10,000 was made for the officers' and employees' pension fund, so that the amount transferred to general surplus was $689,269. In his report President H. S. Holt stated that the gross revenue and surplus earnings showed substantial and satisfactory increases over previous years, even though the operating expenses were increased by advanced prices for raw materials and low-water and ice conditions at the company's hydroelectric plants, necessitating extended operation of the steam plant and purchase of additional energy. The net revenue and net income when compared item for item with last year's account show substantial increases. The accrued surplus is brought up to $4,210,512. The depreciation reserve is invested in the revenue-earning plant. During the year $1,700,000 of new capital stock was issued to shareholders and $100,000 to employees. The proceeds of this and cash on hand will be absorbed in extensive additions to plant and property which it is estimated will cost $2,500,000. The new steam reserve plant at La Salle is well under way. It is equipped for 25,000 hp and designed to have ultimately 50,000 hp. The new steel-pole transmission line between Cedars Rapids and Montreal will be completed simultaneously with the hydraulic development of the Cedars Rapids Manufacturing & Power Company with which the company has contracted for part of its power supply. A reduction of 0.4 cent per kw-hr., or 6 2/3 per cent, will be made for overhead service. Mr. Holt expresses the regret of the directors that they cannot consistently reduce the electric-lighting rate for underground service. In fact, the great difference in costs for this class of service as demonstrated by the cost of the new civic conduits and equipment will render it necessary to establish some fair differential to offset the additional expense entailed.

The Wisconsin-Minnesota Light & Power Company Merger.—The Wisconsin-Minnesota Light & Power Company (until recently the La Crosse (Wis.) Gas & Electric Company) has taken over all the properties formerly owned or controlled by the Chippewa Valley Railway, Light & Power Company and the Chippewa Valley Construction Company. The new company, under the authority of the Railroad Commission of Wisconsin, has increased its capital to $20,000,000. The change was made by the American Public Utilities Company, managed by Kelsey, Brewer & Company. The company now serves a population estimated to exceed 90,000. The largest of the company's hydroelectric plants is the Cedar Falls plant, which has a capacity of about 5500 hp. At present the total capacity of all the company's steam and hydroelectric plants is approximately 14,000 hp, which, President Joseph H. Brewer writes, can ultimately be increased by the development of the company's present water rights to over 100,000 hp. Most of the sixteen cities and towns served by the company are in Wisconsin, while the business in Minnesota is confined to selling energy at wholesale to other public service corporations in Red Wing, Wabasha and Lake City. All of the common stock is owned by the American Public Utilities Company, as is also a portion of the preferred stock. Of the latter $1,500,000 will be sold to the public by Paine, Webber & Company, of Boston, and $2,265,000 of the first and refunding 5 per cent thirty-year bonds will be marketed through the Harris Trust & Savings Bank, of Chicago. These bonds are being offered at 93½ and interest. Mr. Blaine Gavett, secretary of the American Public Utilities Company, mentions two important business possibilities: "The hydroelectric generating stations of the company are within about 90 miles of the twin cities, St. Paul and Minneapolis, and also the iron country along the northern Wisconsin-Michigan border is within reach by the construction of a transmission line. The extension of the present high-tension lines to serve the city of La Crosse will have an immediate effect on the total electrical output of the hydroelectric stations. The territory on both sides of the Mississippi River between La Crosse and the twin cities abounds with excellent energy possibilities. It is our expectation to develop this business as rapidly as conditions will permit." The officers of the new company are Mr. Joseph H. Brewer, president; Messrs. W. B. Parsons and A. E. Pierce, vice-presidents; Mr. Blaine Gavette, secretary; Mr. C. A. Boalt, treasurer; Mr. W. J. Ripley, assistant secretary and treasurer. The directors include all the officers except Mr. Ripley, and Messrs. Charles B. Kelsey, A. W. Higgins, John H. Blodgett, Joseph S. Hart, George A. Whitworth and Charles McPherson.

Business Notes

The Edward J. Hunt Manufacturing Company, of Newark, N. J., has taken over the business formerly carried on by Edward J. Hunt.

The Carbo Steel Post Company, of Chicago, Ill., has removed its main office from Chicago Heights, Ill., to 879 Rand-McNally Building, Chicago.

The Barden Electric & Machinery Company, of Houston, Tex., has abandoned its contracting department and is now engaged exclusively in the jobbing business.

The American Engine & Electric Company.—Harry J. Marks has been advanced from the position of manager of the New York office of the American Engine & Electric Company to that of sales manager of the company. He will divide his time between the New York office, at 90 West Street, and the main office at Bound Brook, N. J.

The United Light Company, of Cincinnati, Ohio, has been organized to take the place of the United Gas Lighting Company. The officers are: President, W. H. Odell; vice-president, I. R. Balcom, and secretary and treasurer, W. R. Divers. The charter of the concern provides that it may manufacture, buy, sell and maintain gas and electric appliances.

The Freeman-Sweet Company, electrical contracting engineer, Chicago, has moved from its former place of business at 538 South Dearborn Street and has taken offices on the second floor of the Transportation Building, 608 South Dearborn Street. The company also has a room on the first floor of the same building, in which it maintains an appliance sales room.

Buffalo Electric Vehicle Company.—W. A. Zimmerman, formerly secretary and general manager of the Mercury Manufacturing Company, has been made director of sales and publicity for the Buffalo Electric Vehicle Company, Buffalo, N. Y. F. C. Brown, formerly district manager for the Chase Motor Truck Company, has been made sales manager of the truck department of the Buffalo Electric Vehicle Company.

Trade Publications

Link Belt.—Section A of Catalog No. 110, a recent publication of the Link-Belt Company, Chicago, Ill., describes detachable link-belts.

Portable Tools.—The Stow Manufacturing Company, Binghamton, N. Y., describes motor-driven portable tools in its latest four-page folder.

Marine Boilers.—Scotch marine boilers with water backs are referred to in a pamphlet sent out by the Murray Iron Works Company, Burlington, Ia.

Brushes.—The Nungesser Carbon & Battery Company, Cleveland, Ohio, has prepared Catalog No. 5, giving information on various grades of brushes.

Fuel-Oil Engine.—Bulletin No. 2 of the Covington Machine Company, Covington, Va., contains descriptions of fuel-oil engines and includes operating data thereon.

Water-Tube Boilers.—The fifth edition of Bulletin No. 2 has been issued by the A. D. Granger Company, New York. It refers to Oswego internally fired water-tube boilers.

Armored Conductors.—The prices of flexible steel conduit, fittings, etc., are listed in a pamphlet being distributed by the Pacific States Electric Company, San Francisco, Cal.

Automobile Electric Equipment.—A. J. Picard & Company, 1720 Broadway, New York, call attention in a folder recently issued to their supply of automobile electrical equipment.

Pneumatic Tires.—The pamphlet issued by A. J. Picard & Company, 1720 Broadway, New York, contains a price list and table of carrying capacities of Firestone pneumatic tires.

Vacuum Cleaner.—A leaflet issued by the Sterling Machine & Stamping Company, Wellington, Ohio, sets forth briefly the superior features of its "Brilliant" suction cleaner.

Electric Specialties.—Catalog D of the Alter Light Company, 827 Loomis Street, Chicago, Ill., illustrates electric fixtures, heating appliances, wiring material and other specialties.

Electric Drill.—A portable electric drill equipped with ball bearings is described in Circular E-1, issued by the Independent Pneumatic Tool Company, Chicago, Ill.

Mechanical Refrigeration.—A refrigerating plant operating on exhaust steam is described in Bulletin No. 16, issued by the Carbondale Machine Company, Carbondale, Pa.

Electric Vehicle Equipment.—Data regarding electric vehicles is contained in Catalog 3002-A, Section 3223, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Motor Drive.—Motor drive for laundry machinery is discussed in Catalog 3002-A, Sections 3164 and 3082, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Storage Batteries.—Titan storage batteries for electric vehicles are the subject of a well-prepared thirty-two-page catalog published by the Titan Storage Battery Company, Newark, N. J.

Electrically Heated Linotype Pot.—An electrically heated wicker-type linotype pot is described in Publication No. 1531 of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Industrial Locomotive.—Leaflet No. 3723, describing Baldwin-Westinghouse industrial locomotives, has been issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Motion-Picture Equipment. — Electrical equipment for motion-picture theaters is described in Folder No. 4277 of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Lighting Fixtures.—The National X-Ray Reflector Company, Chicago, Ill., has issued twelve pages showing new "Eye Comfort" lighting fixtures for inclusion in a binder previously provided.

Heating Devices.—A set of advertisements has been prepared by the American Electrical Heater Company, Detroit, Mich., for use by dealers and contractors in promoting the sale of heating devices.

Portable Ozonators.—Price List No. 852 and Descriptive Bulletin No. 49,000, relating to portable ozonators, have been issued by the Sprague Electric Works of the General Electric Company, New York.

Indirect-Lighting Units.—In two bulletins recently issued by the Mohrlite Company, San Francisco, Cal., numerous illustrations of attractive indirect-lighting units and indirect-lighting installations are shown.

Laundry Machinery.—The Hurley Machine Company, Clinton and Monroe Streets, Chicago, Ill., has issued a sixteen-page booklet illustrating the Thor washing machines and giving a brief talk on its advantages.

High-Voltage Insulator Pins.—So-called "Keystone" truss or high-voltage insulator pins and other transmission-line specialties are described in a catalog issued by the Electric Service Supplies Company, Philadelphia, Pa.

Railway Data.—The relative costs of operation of different railway systems are compared in Westinghouse Railway Data Exchange No. 8, recently issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Electric Control.—An article by Mr. H. F. Stratton, "Lifting the 130,000-lb. Quebec Bridge," recently published in the *Engineering Magazine*, has been reprinted in pamphlet form by the Electric Controller & Manufacturing Company, Cleveland, Ohio.

Gages.—The Bristol Company, Waterbury, Conn., in Bulletin No. 189 illustrates and describes its recording differential-pressure gages and recording flow-rate meters, float type, models 1010 and 1110. Bulletin No. 188 refers to recording differential-pressure gages and flow-meters.

Power-Plant Appliances.—A number of bulletins containing illustrations and tables have been brought out by the Sims Company, Erie, Pa., under one cover. The titles of these bulletins are as follows: "Closed Feed-Water Heaters," "Open Feed-Water Heaters," "Hot-Water Generators and Converters," "Clean E-Z Steam Tube Storage," "Price Lists and Tabulations," "Laundry Heaters," "Steam Separators," "Exhaust Heads," "Oil Extractors," "Oil Filters," "Low Water Alarms" and "Compound Feeders."

Oil Engines.—The McIntosh & Seymour Corporation, Auburn, N. Y., has issued Bulletins No. 51, 53 and 54 relating to Diesel oil engines.

Telephone Cable.—The Western Electric Company, New York, has published a booklet describing the manufacture of lead-covered telephone cable.

Small Tungsten Lamps.—H. W. McCandless & Company, New York, have sent out folders on miniature automobile and candelabra tungsten lamps.

Electric Toaster Stove.—A folder describing its combined toaster stove is being distributed by the American Electrical Heater Company, Detroit, Mich.

Automobile Horn.—A leaflet recently issued by the Automobile Supply Manufacturing Company, Brooklyn, N. Y., tells about its "Apollo" electric horn.

Wall Boxes.—The Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., has issued a folder describing its Uni-Sectional steel wall boxes.

Motor-Operated Drills.—Portable motor-driven drills are described in the pamphlet issued by the United States Electrical Tool Company, Cincinnati, Ohio.

Cable-Splicing Joints.—Applications of the Matthews cable-splicing joints are described in a pamphlet issued by W. N. Matthews & Brothers, St. Louis, Mo.

Oil Fuse Cutouts.—Circular No. 150 of the D & W Fuse Company, Providence, R. I., describes oil-immersed fuse cutouts adapted to high-tension service.

Engineering Service.—H. M. Byllesby & Company, Chicago, Ill., are sending out a placard briefly describing a large electrical development which they have made.

Crane Motors.—Leaflet 2364-A issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., contains information on direct-current crane motors.

Rope Drive.—Bulletin O of the Mesta Machine Company, Pittsburgh, Pa., states the advantages of rope drive and contains data on the life of manila transmission rope.

Data on Insulation.—A booklet of forty-eight pages, issued by the Dielectric Manufacturing Company, St. Louis, Mo., bears the title "Data on Dependable Insulation."

Cables.—Steel-tape-armored cables are discussed in Bulletin No. 680-1, issued by the Standard Underground Cable Company, Pittsburgh, Pa. Ten illustrations are shown.

Underground Gasoline Tanks.—A recent catalog of the Wm. B. Scaife & Sons Company, Pittsburgh, Pa., describes underground gasoline storage tanks and garage air tanks.

Voltage Regulator.—A pamphlet discussing characteristics and applications of the Thompson voltage regulator has been issued by the Thompson-MacArthur Company, Buffalo, N. Y.

Steel-Taped Cable.—The Simplex Wire & Cable Company, Boston, Mass., will furnish on request a booklet on the uses of steel-taped cable and the cost of installing this product.

Electric Signs.—The Sun Electrical Company, Ltd., 120 Charing Cross Road, London, has published a catalog on electric signs equipped with mechanical and thermo-flasher devices.

Electric Fans.—Catalog No. 14-F of the Menominee Electric Manufacturing Company, Menominee, Mich., contains a brief description and the price list of several sizes and types of fans.

Auto-Starters.—Auto-starters for polyphase induction motors are described in Leaflet No. 3512-A, issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Busbar Supports.—A leaflet referring to unit-type high-tension busbar supports and a portable phase-rotation indicator has been issued by the Delta Star Electric Company, Chicago, Ill.

Radio Receiving Head Set.—Head-receivers for radio-telegraphy are described in the pamphlet issued by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.

Pole-Top Switches.—The Railway & Industrial Engineering Company, Pittsburgh, Pa., has issued a leaflet giving the cost, durability, reliability and application of Burke pole-top switches.

Refractory Materials.—In a leaflet circulated by the Laclede-Christy Clay Products Company, St. Louis, Mo., the company points out the particular industries to which its products are adapted.

Glass Fixtures.—Placards illustrating and briefly describing some of its glass products are being circulated by the Gleason-Tiebout Glass Company, 71 West Twenty-third Street, New York.

Electroplating Machines.—The Munning-Loeb Company, Matawan, N. J., in its Bulletin No. 400 illustrates and describes its "Nonesuch" electroplating machine and "Nonesuch" carboy rockers.

Heating Devices.—The Menominee Electric Manufacturing Company, Menominee, Mich., has sent out some leaflets on electric shoe and hair driers and a flatiron designed for heating curling irons.

Laboratory Apparatus.—Pamphlets and leaflets are being sent out by the Arthur H. Thomas Company, Philadelphia, Pa., describing laboratory apparatus, including high-temperature electric furnaces.

Automobiles.—The seventeenth annual announcement of new models of Waverley automobiles has been issued by the Waverley Company, Indianapolis, Ind., in a well-printed, fully illustrated pamphlet.

Plastic Cement.—S. A. Industries Chimiques, Chiasso, Switzerland, have issued a pamphlet written in French describing the characteristics and preparation of a plastic cement for fastening insulators to pins.

Conveyors.—Book No. 195 of the Link-Belt Company, Philadelphia, Pa., shows a class of machinery that has been developed for handling newspapers, magazines, stereotype plates and various packages in printing establishments.

Concrete Products.—The National Reinforced Concrete Pole, Pile & Pipe Company, Denver, Col., is sending out an illustrated twenty-seven-page booklet describing the R. M. Jones method of manufacturing concrete poles, piles and pipes.

Meters.—Ampere-hour and two-wire watt-hour meters are described in Bulletins No. 38 and 39 of the Sangamo Electric Company, Springfield, Ill. An addendum to Bulletin No. 36 contains a brief description of all types of ampere-hour meters. Another pamphlet describes ampere-hour meters for electric vehicles.

New Industrial Companies

The Acme Electric Storage Battery Company, of Chicago, Ill., has been incorporated with a capital stock of $14,000 to manufacture and deal in storage batteries. The incorporators are Roy Brundage MacDowell, Sidney J. Hall and A. C. Hunt.

The Bachlet Medical Apparatus Company, of Brooklyn, N. Y., has been incorporated by R. S. Padgett, C. Dooley and L. Sherman, of Brooklyn, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in electric and medical apparatus, etc.

The Niagara Battery Company, of Buffalo, N. Y., has been chartered with a capital stock of $5,000 to manufacture and deal in storage batteries. The directors are George H. Woodward, H. Barton Parry, E. C. Schlenker, J. N. Alcott and E. L. Marshall, all of Buffalo.

The Safety Fire Door Company, of Brooklyn, N. Y., has been chartered with a capital stock of $50,000 to manufacture safety fire doors, light ironwork, mechanical and electrical appliances, etc. The incorporators are T. Raskin, I. Raskin, of Brooklyn, and A. Warshow, of the Bronx.

The Standard Electric Stove Company, of Toledo, Ohio, has been incorporated with a capital stock of $100,000 to manufacture an electric stove that may also be used as a fireless cooker. The company has leased a building at Jackson and Twelfth Streets, Toledo. The directors are P. C. Tiedman, president; S. L. Kelly, Charles S. Turner, Luther D. Smith and F. M. Bostater.

Personal Mention

Mr. J. F. Thomson has been elected president of the Darien (Ga.) Ice & Light Company.

Mr. Lloyd S. Purall has been appointed manager of the Leavenworth (Kan.) Light, Heat & Power Company.

Mr. O. E. Green has been appointed superintendent and manager of the municipal electric-light plant, Lyons, Ga.

Mr. C. Hill has succeeded Mr. C. A. Marbin as local manager for the Kansas Gas & Electric Company at Cherryvale, Kan.

Mr. W. Allester, formerly city electrician at Ladysmith, B. C., is now operating engineer of the local municipal plant.

Mr. H. C. Strong has been appointed vice-president of the Citizens' Light, Power & Water Company, Ketchikan, Alaska.

Mr. J. P. Walters has succeeded Mr. M. Laas as local manager of the Iowa Railway & Light Company at Blairstown, Ia.

Mr. W. H. Tucker has been appointed secretary and general manager of the Columbiana (Ala.) Ice, Light & Power Company.

Mr. D. H. Johnson has succeeded Mr. J. H. Humphrey as superintendent of the Butler (Pa.) Light, Heat & Motor Company.

Mr. Robert J. Markley has been appointed manager of the commercial department of the Shenango Valley Electric Company, Sharon, Pa.

Mr. William M. Hope has been appointed general manager of the Phoenix Company, which supplies electric service at Harrington, Del.

Mr. S. R. Bertron, Jr., has succeeded Mr. Thomas Rhodes as manager of the Consumers' Electric Light & Power Company, New Orleans, La.

Mr. H. C. Hoagland has been appointed general manager of the Fort Smith (Ark.) Light & Traction Company, succeeding Mr. J. Walter Gillette.

Mr. Hugh S. Riddell, formerly contract agent of the Greenfield (Mass.) Electric Light & Power Company, is now superintendent for the company.

Mr. E. E. Robinson has been appointed superintendent of the Southern Sierras Power Company's plant at Elsinore, Cal., succeeding Mr. P. L. Nourse.

Mr. D. R. Kennedy has succeeded Mr. Fred Coats as superintendent of the Southern Sierras Power Company's hydroelectric plants at Bishop, Cal.

Mr. E. B. Korst has resigned as manager for the Central Illinois Public Service Comapny at Pittsfield, Ill., to open an electric shop at St. Augustine, Fla.

Mr. W. O. Brooks has been appointed operating engineer of the Abbeville (Ga.) Electric Light, Water & Power Company as successor to Mr. J. J. Peterson.

Mr. J. D. Hayden has succeeded Mr. C. E. Shelton as superintendent of the plant operated by the Mountain Lake Park Association, Mountain Lake Park, N. Y.

Mr. R. L. Brooks has been appointed manager and superintendent of the Abbeville (Ga.) Electric Light, Water & Power Company, succeeding Mr. C. A. Childs.

Mr. A. W. Burke has been appointed superintendent of distribution for the Wilmington & Philadelphia Traction Company, Wilmington, Del., succeeding Mr. D. L. Ott.

Mr. C. B. Arnold has been appointed operating engineer of the Intermountain Railway, Light & Power Company, Laramie, Wyo., successor to the Laramie Electric Company.

Mr. S. G. Cunningham has been appointed purchasing agent of the Arkansas Valley Railway Light & Power Company, Pueblo, Col., succeeding Mr. George W. Milliken.

Mr. S. N. Clarkson, assistant sales manager of the Union Electric Light & Power Company, St. Louis, Mo., is absent on a visit to his relatives in Australia. Mr. Clarkson sailed by way of San Francisco, Honolulu, Pago Pago and Sydney.

Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, sailed for Europe on the *Vaterland* on July 7. He expects to be away about five weeks, and will combine business and a vacation.

Mr. R. E. Thompson has been appointed superintendent and chief engineer of the Fort Smith (Ark.) Light & Traction Company, succeeding Messrs. L. R. Robertson and A. Patterson, who were chief engineer and electrical engineer respectively.

Dr. Robert H. Whitten has resigned as librarian-statistician of the New York Public Service Commission, First District, in order to become secretary of the committee on city plan of the Board of Estimate and Apportionment of New York City.

Mr. R. W. Chisholm, formerly vice-president of the Colorado Springs (Col.) Light, Heat & Power Company, has been appointed vice-president of the Intermountain Railway, Light & Power Company, Laramie, Wyo., successor to the Laramie Electric Company.

Mr. Leland D. Wood has been appointed manager of the Taunton (Mass.) municipal lighting plant, succeeding Dr. M. C. Golden. Mr. Wood is a graduate of the Massachusetts Institute of Technology and has been until recently employed by the Brockton (Mass.) Edison Electric Illuminating Company.

Mr. Ernest Lunn, until recently storage-battery engineer of the Commonwealth Edison Company and president of the Walker Vehicle Company, has resigned those positions and has become chief electrician of the Pullman company, with office in the Pullman Building, Chicago. This change took effect on July 1. Mr. Lunn is an associate of the American Institute of Electrical Engineers and has taken an active interest in the affairs of the Electric Vehicle Association of America.

Mr. Elmer A. Sperry, the successful tests of whose aeroplane-stabilizing device at Bezons, France, were noted in our issue dated June 27, was awarded the first prize of 50,000 francs in the aerial security contest held at Bezons on July 2. Mr. Sperry was born on Oct. 12, 1860, at Cortland, N. Y., and received his engineering education at Cornell University. He served as electrical engineer for the Sperry Electric Company, the Standard Electric Company, the Sperry Electric Mining Machinery Company, the Sperry Engineering Company and the Sperry Electric Railway Company, and is now president and engineer of the Sperry Gyroscope Company, Brooklyn, N. Y. Mr. Sperry returned to America July 8 on board the White Star liner *Olympic.*

Mr. Francis A. Vaughn, who has been appointed to the newly created position of engineer of the street-lighting survey, Milwaukee, Wis., is vice-president-elect of the Illuminating Engineering Society for the Chicago Section. He is also a member of the firm of Vaughn, Meyer & Sweet, consulting engineers, Milwaukee. Mr. Vaughn was graduated from the electrical engineering course of the University of Wisconsin in 1895. Subsequent to that time he was employed in the testing department of the Standard Telephone Manufacturing Company, Madison, Wis., as draftsman with the Gibbs Electric Company, Milwaukee, and for fourteen years with the Milwaukee Electric Railway & Light Company. In the latter organization he passed successively through the operating, engineering, meter-testing and distributing departments. Mr. Vaughn is a Fellow of the American Institute of Electrical Engineers, and a member of the National Electric Light Association and the Illuminating Engineering Society. He is president of the Milwaukee Electrical League and has served as trustee of the Engineering Society of Wisconsin and chairman of the Wisconsin Electrical Association committee on revision of the Wisconsin Railroad Commission's electric-service rules.

FRANCIS A. VAUGHN

Construction

New England

NASHUA, N. H.—The Public Service Commission has approved the purchase of the property of the Nashua Lt., Ht. & Pwr. Co. by the Manchester Trac., Lt. & Pwr. Co., of Manchester. The traction company has been authorized to issue $280,000 in capital stock, of which $224,280 will be used to take over the stock of the Nashua company and the remainder to pay off outstanding indebtedness and for the erection of a transmission line between Manchester and Nashua.

BOSTON, MASS.—Bids will be received by the schoolhouse commission of the city of Boston, 120 Boylston Street, Boston, until July 17 for furnishing and installing wiring and electrical material in Mechanical Arts High School, Belvidere Street.

DALTON, MASS.—The contract for equipping the finishing mill of the Old Berkshire mill in Dalton for electrical operation has been awarded to the Albert V. Phillips Electrical Machine Works, of Pittsfield. General Electric motors and transformers will be used.

GARDNER, MASS.—Arrangements have been made by the Board of Selectmen with the Gardner El. Lt. Co. for the installation of 59 additional lamps. J. D. Whittemore is superintendent of Gardner El. Lt. Co.

GEORGETOWN, MASS.—The State Legislature has passed the bill which allows the town of Georgetown to sell electricity in Rowley and in a part of the town of Newbury.

LEXINGTON, MASS.—Plans are being considered for installing an ornamental lighting system through the center of the town and around the Lexington battle green.

HARTFORD, CONN.—The Connecticut Co., it is reported, is contemplating making extensive changes to its power plant on Commerce Street.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the trustees of public buildings, Capitol, Albany, until July 20 for lighting fixtures, west wing; bracing fire line and moving motor generator for the New York State Capitol. Bids will also be received at the same time and place for electric wiring for book stacks for the State Educational Building, Albany. Plans and specifications may be obtained at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

BATAVIA, N. Y.—The Genesee Lt. & Pwr. Co., of Batavia, is installing an electric distributing system in the village of East Pembroke. The East Pembroke Canning Co. recently signed a contract with the company for electric service.

BROOKLYN, N. Y.—The American Mfg. Co. has decided to abandon its private power plant and has contracted with the Kings County El. Lt. & Pwr. Co., of Brooklyn, for energy to operate the factory, the minimum demand to be at least 3,000 kw, with a maximum of 4000 kw. The cost of the change is estimated at about $80,000.

CANAAN, N. Y.—The Lebanon Pwr. & Ltg. Co., recently organized, has purchased the old Queechy paper mill and its three water rights in Canaan. The company, it is understood, proposes to furnish electricity in Canaan and the Lebanon Valley. Fred Munch, of Dalton, is interested.

CLYDE, N. Y.—The Village Board has entered into a contract with the Central New York Gas & El. Co., of Geneva, for lighting the village park for a period of five years. Ornamental lamps are to be placed at intervals of 50 ft. around the edge of the park.

LESTERSHIRE, N. Y.—Preliminary arrangements are being made by the Binghamton Lt., Ht. & Pwr. Co., of Binghamton, for the installation of a new street-lighting system. Under the new contract the company will furnish 150 street lamps.

LOCKPORT, N. Y.—The Buffalo, Lockport & Rochester Ry. Co., reported to be working in conjunction with the International Ry. Co., has closed a contract with the Niagara, Lockport & Ontario Pwr. Co., for use of the transmission-line right-of-way from Hinman Station west of Buffalo to Niagara, with a view of constructing an electric railway from Buffalo to Niagara Falls.

MALONE, N. Y.—Bids will be received by E. C. Rider, superintendent Northern New York Institution for Deaf-Mutes, Malone, until July 22, for furnishing electric generating equipment at the Northern New York Institution for Deaf-Mutes. For details see proposal columns.

MALONE, N. Y.—The Public Service Commission has authorized the Malone Lt. & Pwr. Co. to issue $50,000 in capital stock and $348,000 in bonds, the proceeds to be used to purchase the property and franchises of the Franklin County Hydraulic Co., which operates a hydroelectric plant and transmission lines.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until July 20 for installing electric equipment in new Public School 56, located on East 207th Street, borough of the Bronx, for installing electric equipment in new Public School 95, located on Larremore Avenue, Queens Borough, and for installing electric equipment in new Public School 96, located at the corner of Rockaway Road and Lincoln Avenue, borough of Queens.

POUGHKEEPSIE, N. Y.—Preliminary surveys, it is reported, are being made by Runyon & Carey, engineers, of Newark, N. J., for the proposed municipal electric-lighting system in Poughkeepsie. D. W. Wilbur is Mayor.

SOUTHOLD, N. Y.—The Town Board has granted the Consumers' Gas Co. a franchise to furnish electricity in Southold and Greenport Village. The company, it is reported, has taken over the holdings of the Cutchogue El. Co., of Southold.

SYRACUSE, N. Y.—The Public Service Commission has granted the Syracuse Ltg. Co. permission to issue $434,000 in bonds for extensions and improvements.

WELLSVILLE, N. Y.—The Wellsville El. Lt., Ht. & Pwr. Co. has recently installed three 100-hp boilers. John K. Cochran is superintendent.

ALBION, PA.—The Albion Lt. & Pwr. Co. expects to purchase a boiler within the next three months; also within the next two months a line of heating and cooking devices, etc. The company has recently installed some tub transformers. T. H. Flower is treasurer. The company has filed an amendment to its charter increasing the capital stock to $100,000.

BIRDSBORO, PA.—The Council is contemplating calling an election to submit the proposal to make an appropriation for the installation of a municipal electric-light plant to the voters.

CORRY, PA.—Within the next three months the Corry City El. Lt. Co. expects to erect 12 miles of transmission line connecting Corry and Union City and intervening towns; also to purchase generating, auxiliary and switching equipment for a central station to furnish electricity for patrons along the line. The company will also purchase material for distribution systems necessary to operate the consolidated plants. The controlling stock of the Corry City El. Lt. Co. and the Union City El. Lt. Co. has been purchased by the Interstate El. Co., 115 Broadway, New York, N. Y., of which A. E. Fitkin, of New York, is treasurer. B. E. Waltz is local manager.

ERIE, PA.—The contract for laying conduit system in State street has been awarded to Joseph McCormick & Brother, of Erie. B. E. Briggs is city engineer.

KITTANNING, PA.—The City Council has decided to abandon the proposal to construct a municipal electric-light plant for the present.

MECHANICSVILLE, PA.—The Borough Council has granted the Eastern Pennsylvania Lt., Ht. & Pwr. Co., of Pottsville, a franchise to erect transmission lines to supply electricity in Mechanicsville.

PITTSBURGH, PA.—The City Council has passed an ordinance requiring all electric and telephone wires to be placed in underground conduits.

RIDGWAY, PA.—Plans, it is reported, are being considered for the erection of a central power station near Ridgway which will furnish electricity in Ridgway, Johnsonburg and St. Mary's.

TARENTUM, PA.—Bids will be received by the Borough Council until July 20 for construction of approximately 4000 ft. of 12-in. sanitary sewer, including treating plant with necessary piping, valves and mechanical and motor-driven centrifugal pumps. Plans and specifications may be obtained from Leo Hudson, consulting engineer, House Building, Pittsburgh. W. F. Denny is president of Council.

WILKES-BARRE, PA.—A company is being organized by G. Mortimer Lewis, an attorney, and Clarke S. Totten, an illuminating engineer, to construct a plant to furnish electricity and steam heat to consumers in the block bounded by South Main, Northampton and Franklin Streets and Anhauser Lane.

BUTLER, N. J.—At a special election held June 30 the proposal to issue $30,000 in bonds for the installation of a municipal electric-light plant was carried.

NEWARK, N. J.—Bids will be received at the office of the Board of Street and Water Commissioners, City Hall, Newark, until July 16 for lighting the streets of the city with 3000 arc lamps of 2000 cp, and approximately 200 incandescent lamps, with option by mutual agreement to install nitrogen lamps of 400 cp, 600 cp and 1000 cp, type C Mazda lamps of 20-amp type operating on 7½ amp, alternating-current series circuits, with all-night and every-night service, for alternative terms of three and five years from Sept. 1, 1914; also to submit price per lamp per year for the General Electric flame-arc type now used on Market Street, Newark. M. R. Sherrerd is chief engineer.

BALTIMORE, MD.—The contract for replacing steam apparatus with electrically driven machinery in engine and boiler rooms of the Belvedere Hotel has been awarded to Chatard & Norris, Continental Building, Baltimore. Electricity will be secured from local transmission lines. William H. Hager is manager of hotel.

FROSTBURG, MD.—The Public Service Commission has approved the sale of the property of the Frostburg Illg. & Mfg. Co. to the Hagerstown & Frederick Ry. Co., of Frederick. Authority was also granted to the railway company to issue $50,000 in bonds, of which $35,000 will be used to pay for the property and the remainder for improvements to its plant.

CLARKSBURG, W. VA.—Plans are being prepared by Sidney B. Martin, Penn Building, Pa., for the erection of a power plant for the Clarksburg Gas & El. Co., to cost about $100,000. The equipment to include steam turbines, condensers, centrifugal pumps, boiler-feed pumps, feed-water heaters, high-pressure steam piping, etc.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Pwr. Co. has applied to the Public Service Commission for permission to construct a dam at Tygart's Valley, to furnish water for a large hydroelectric power plant which it proposes to build.

WHEELING, W. VA.—The Neff-Burns El. Co., recently organized, will operate a plant for the manufacture of various electrical appliances, which will be equipped with electrically operated machinery. E. W. S. Neff, William J. Burns and others are interested in the project.

WASHINGTON BARRACKS, D. C.—Bids will be received at the United States Engineer Depot, Washington Barracks, until July 23 for furnishing one direct-current 16-panel switchboard. For further information address Lt. Col. Joseph Kuhn.

North Central

CADILLAC, MICH.—The Commonwealth Pwr. Co., of Jackson, has purchased the right of way from Manistee County into Cadillac for a transmission line. The company is planning to furnish electricity in Cadillac generated at the Stronach Dam on the Manistee River.

DETROIT, MICH.—Plans are being considered by the Grand Laundry, Lafayette and Brooklyn Avenues, Detroit, for the installation of an electric plant to furnish electricity for lamps and motors for the laundry.

DETROIT, MICH.—Preparations are being made to double the output of the Ford Motor Co. in Detroit, at a cost of about $5,000,000. The plans provide for the erection of seven new buildings, 60 ft. wide, 900 ft. long and six stories high, costing about $500,000 each, and a power house, 85 ft. high, 150 ft. wide and 240 ft. long, to cost approximately $1,500,000, which will be equipped with a 30,000-hp gasoline engine. Two of the buildings are nearly completed.

FENTON, MICH.—The property of the Fenton Lt. & Pwr. Co. will be sold by F. A. Beard, receiver, at auction on July 20.

JACKSON, MICH.—The city of Jackson has recently entered into a new contract with the Commonwealth Pwr. Co., of Jackson, for a period of ten years, which provides for the installation of an ornamental lighting system in the business section. Tungsten cluster lamps will be used.

ST. CLAIR HEIGHTS, MICH.—The Village Trustees are considering the installation of a new lighting system. Francis J. Miller is president of board.

WYANDOTTE, MICH.—Bonds to the amount of $40,000 have been voted to improve the municipal electric-light plant and water-works system.

ARCHBOLD, OHIO.—Within the next six months the Archbold El. Lt. & Pwr. Co. expects to erect 10 miles of transmission lines and to purchase poles, wire, trans-

formers and lightning arresters for same. R. S. Rodenhuis is general manager.

ATHENS, OHIO.—The Ohio El. Pwr. Co., which is now erecting a central electric power plant at Floodwood, will soon establish central offices in Athens.

CANTON, OHIO.—The Canton El. Co. has purchased a 7500-kw General El. Co. (not yet installed). The company is now installing three 2000-kva, 22,000/11,000-volt General Electric transformers. The addition to substation to provide space for these transformers is nearly completed.

CANTON, OHIO.—O. C. Barber, of Canton, who operates an electric power plant at Howenstein in connection with a lime plant, is making investigation with reference to enlarging the plant to furnish electricity to a number of cities and towns for municipal, industrial and domestic purposes. The cost of the plant is estimated at $2,500,000.

CINCINNATI, OHIO.—Plans are being considered by the city officials for submitting to the voters at the election to be held next November the proposal to issue between $10,000,000 and $12,000,000 in bonds for the construction of a rapid-transit system in the old canal bed in Cincinnati. The cost of a subway system in the canal bed, exclusive of power plant and equipment, is estimated at $7,000,000, and the power plant, equipment, downtown loop and other accessories, exclusive of rolling stock, will bring the cost to between $10,000,000 and $12,000,000.

COLUMBUS, OHIO.—The City Council has authorized a bond issue of $18,000, the proceeds to be used to purchase new equipment for the municipal electric-light plant, in order that the cluster-lamp lighting system in the city may be extended.

FREMONT, OHIO.—The Ohio Lt. & Pwr. Co. is contemplating doubling the output of its local plant.

JEWELL, OHIO.—The Ridgeville Lt. & Pwr. Co., recently organized, is contemplating the erection of a transmission line from Jewell to Ridgeville. D. D. Douty, of Defiance, and John Douty, of Napoleon, are interested in the company.

LIMA, OHIO.—The Western Ohio R.R. Co., of Lima, it is reported, is contemplating extending its transmission lines to furnish electricity for lamps and motors in Pemberton, Quincy, Rosewood, DeGraff and eventually to Bellefontaine.

LIMA, OHIO.—The light committee, it is reported, will recommend submitting to the voters at the November election the proposal to issue $76,000 in bonds to establish an ornamental lighting system in the business district, and for the installation of an electric generating plant in the East Lima water station to supply electricity for maintaining the lamps; also to light the city parks, bridges and other municipal property.

LOVELAND, OHIO.—The property of the Loveland Citizens' El. Co. has been sold by Arthur E. Jones, receiver, to Fred Fabel, representing the bondholders, for $75,000. The company will be reorganized.

MARIETTA, OHIO.—Within the next few months the Board of Public Service expects to purchase one 150-kw, two-phase, 60-cycle, alternating-current, revolving-field generator and one 300-hp water-tube boiler. The installation of an ornamental lighting system is also under consideration. J. A. Schlumberger is superintendent.

MARTINS FERRY, OHIO.—The Wheeling El. Co., of Wheeling, W. Va., has submitted a proposal to the Board of Trustees of Public Affairs offering to furnish electricity in Martins Ferry.

MARYSVILLE, OHIO.—Within the next two months the Marysville Lt. & Wtr. Co. expects to erect about 12 miles of transmission lines and six 13,000-volt to 2300-volt transformers; also to purchase 460 poles, lightning arresters and 36 miles of copper wire. Mayne Mackan is superintendent.

MASSILLON, OHIO.—The Massillon El. & Gas Co. has taken out a permit for the erection of a one-story brick power house on South Erie Street, to cost about $20,000. R. A. Brooks is general manager.

MIDDLEPORT, OHIO.—The Ohio River El. Ry. & Pwr. Co., of Pomeroy, has petitioned the Public Utilities Commission for permission to purchase the electric line owned by Richard Ellis, of Middleport, at $30,000.

PRAIRIE DEPOT, OHIO.—Within the next two months H. L. Wilson, proprietor of the local electric-light plant, expects to purchase a new oil engine, to replace steam engine, and a 220-volt, direct-current generator.

SPENCERVILLE, OHIO.—At an election held recently the proposal to issue $10,000 in bonds to rebuild the municipal electric-light plant was carried.

SPRINGFIELD, OHIO.—Plans, it is reported, are being prepared by Robert C. Gotwald, architect, for the construction of a power plant at Wittenburg College.

STEUBENVILLE, OHIO.—The City Council is contemplating extending the electric-lighting system on Market and Fourth Streets.

URBANA, OHIO.—Under the new franchise granted the Urbana Lt. Co., all the wires of the company in the business district will be placed underground at once.

WARREN, OHIO.—The plant of the Western Reserve Steel Co., which is being erected in Warren, will consist of six sheet mills, three roughing mills and three cold mills, which will be driven by a 1600-hp motor. Various auxiliaries will be installed in the sheet-mill departments, including cranes, shears, lathe, machine shop, stokers, etc. In addition to the sheet mill the company will operate galvanizing sheet-metal roofing and corrugating department. Electrical equipment has not been purchased. About 7,000,000 kw of electricity per year will be required to operate the plant. The company has contracted with the Trumbull Pub. Ser. Co., of Warren, for electrical energy. The steel plant is situated about 2 miles from the central station of the Trumbull company, which will erect a double feed wire to the steel works. C. G. Thomas is president of the steel company.

ASHLAND, KY.—We are advised that Rufas Vansant is not interested in the project to establish an electric-light plant and water-works system in Ashland, as reported in the issue of June 13.

BURKESVILLE, KY.—A franchise has been granted to George H. Greenup and others, of Elizabethtown, to install and operate an electric-light plant and water-works system in Burkesville.

DANVILLE, KY.—The capital stock of the Danville Lt., Pwr. & Trac. Co., it is reported, has been increased from $50,000 to $100,000.

HAZARD, KY.—The Hazard Dean Coal Co., it is reported, is installing a new power plant at its mines, near Hazard.

HAZEL, KY.—The Commercial Club has appointed a committee to make investigations as to the cost of establishing and maintaining an electric-light plant and water-works system.

LA GRANGE, KY.—The Louisville Ltg. Co. has been granted a permit to enter the town of La Grange to furnish electricity for lamps and motors.

LEXINGTON, KY.—The contract for installing an electric light and heating plant at the Transylvania University has been awarded to Frank Corbin.

OWENSBORO, KY.—Work has begun on the construction of the distributing system of the municipal electric-light system. New material, including poles and wire, etc., will be used throughout, with automatic cut-offs on every branch. Asa Williams is superintendent.

BAINBRIDGE, IND.—At a meeting of the business men, held recently, it was decided to let the contract for electric lighting to the Roachdale Lt. & Pwr. Co., of Roachdale. The Roachdale Co., it is stated, is building a new plant at a cost of $18,000.

CORYDON, IND.—The Interstate Pub. Ser. Co., of Indianapolis, which has acquired the property of the Corydon Lt. & Wtr. Co., it is reported, has prepared tentative plans for the extension of a high-tension transmission line from New Albany to Corydon, along the Corydon pike. This line would furnish electricity to towns and farmers along the route as well as in Corydon. It is understood that steps have been taken to secure franchises in Edwardsville, Georgetown and Lanesville.

CHICAGO, ILL.—The Pub. Ser. Co. of Northern Illinois, of Chicago, is reported to be contemplating the construction of a large dam and power plant on the Des Plaines River, 10 miles east of Morris

DIXON, ILL.—The Illinois Public Utilities Commission has issued a certificate of convenience and necessity permitting the Illinois Northern Utilities Co., of Dixon, to erect transmission lines from Polo to Amboy, from Morrison to Prophetstown, from Sandwich to Hinckley, from Belvidere to Marengo, and from Genoa to Kirkland.

EAST DUBUQUE, ILL.—The contract between the City Council and the Union El. Co., of Dubuque, Ia., which provides for furnishing electricity for lighting purposes and for pumping water for the city has been approved by the Public Utilities Commission of Illinois.

LA CROSSE, WIS.—The La Crosse Gas & El. Co. has changed its name to the Wisconsin-Minnesota Lt. & Pwr. Co. and has acquired the property of the Chippewa Valley Lt. & Pwr. Co., of Eau Claire, and valuable water-power rights on the Chippewa, Flambeau, Red Cedar and Menominee Rivers, capable of developing 100,000 hp. The new company proposes to develop these water-powers to generate electricity to operate the utilities now controlled by it and also to erect a transmission line to St. Paul and Minneapolis.

LYONS, WIS.—Permission has been granted C. E. Partee, secretary of the Burlington El. Lt. & Pwr. Co., representing the Wisconsin Gas & El. Co., of Kenosha, for the erection of a transmission line through Lyons. The Wisconsin company proposes to furnish electricity in Elkhorn, Lake Geneva and Delavan. By this arrangement both Lyons and Springfield will be furnished with electrical service.

MILWAUKEE, WIS.—A committee has been appointed by the Twelfth Street Advancement Association to investigate the question of improving the street-lighting system.

SUPERIOR, WIS.—Plans have been submitted to the City Commission by W. H. Winslow, general manager of the Superior Wtr. & Lt. Co., for improving the street-lighting system. The company proposes to replace the present arc lamps with the new nitrogen tungsten lamps.

WEYAUWEGA, WIS.—The Weyauwega El. Lt. Co. is planning to install a new generator in its plant; also to install meters and establish a day service.

COTTONWOOD, MINN.—The Council is reported to have granted a franchise to B. Cleland and E. Hanson, of Iroquois, S. D., to install an electric-light plant here.

ELBOW LAKE, MINN.—The town has voted to sell the municipal electric-light plant. The Otter Tail Pwr. Co., of Fergus Falls, it is reported, will purchase the system.

LAKE BENTON, MINN.—Plans are being considered for the installation of an electric-light plant in Lake Benton. L. W. Liddle is reported to be interested.

SLAYTON, MINN.—The Council has granted Victor Klinger a franchise to operate an electric-light plant in Slayton for a period of 25 years.

DELMAR, IA.—The Maquoketah Lt. & Pwr. Co., of Maquoketah, has been granted a franchise to furnish electricity in Delmar for a period of 25 years.

LADORA, IA.—The installation of an electric-lighting system here is under consideration. Robert Shedenheim, of Ladora, is reported interested in the project.

LE MARS, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 23 for construction, complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Le Mars. Drawings and specifications may be obtained at the above office or from the custodian of site at Le Mars. O. Wenderoth is supervising architect.

NASHUA, IA.—The Cedar Valley Pwr. Co., of Charles City, which recently took over the local electric-light plant, it is reported, will build a new concrete dam and install an additional electric generator.

WYOMING, IA.—At a special election held recently the proposal to grant a franchise to William G. Dows, Isaac B. Smith and John A. Reed to construct and operate an electric-light plant in Wyoming was carried.

BRUNSWICK, MO.—The Brunswick Lt. & Wtr. Co. is installing a 72-in. by 18-in. boiler and an 11-in. by 18-in. Murray Corliss engine in its power plant. The company changed hands on May 1. The new officers are: J. A. Nickell, president; L. A. Nickell, vice-president, secretary and manager, and J. W. Nickell, treasurer.

CABOOL, MO.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

CLARENCE, MO.—Bonds to the amount of $10,000 have been voted for improvements to the municipal electric light plant in Clarence.

COLUMBIA, MO. — Negotiations have about been completed, it is reported, between the Commercial Club of Columbia and W. J. Delaney, Frank Kidd and J. B. Trescott, of St. Louis, and F. S. Mordaunt, of Chicago, Ill., for building and equipping an electric railway, including power house.

HAMILTON, MO.—A franchise, it is reported, has been granted to C. A. Martin and T. D. Parr to operate an electric-light plant in Hamilton.

NEW LONDON, MO.—The Public Service Commission has issued a certificate of public convenience authorizing the North Missouri Lt. & Pwr. Co. to install a plant and furnish electrical service in New London. The company distributes electricity generated at the power dam on the Mississippi River at Keokuk, Ia.

ST. LOUIS, MO.—The Board of Public Improvements has decided to have 3 miles of overhead electric light and power wires on Grand Avenue placed underground in 1915.

CASSELTON, N. D.—Within the next two months Lloyd Lynch and Chester Hallett, owners of the local electric-light plant, expect to install a 25-hp Fairbanks-Morse oil engine and a 15-kw, 220-volt direct-current generator to take care of the day load. Ten additional street lamps are being installed. Through error this item appeared under Casselton, N. B., in the issue of July 4.

ELLENDALE, N. D.—Within the next two months the Ellendale El. Co. expects to install a new electric-light plant in Ellendale. G. F. Phillips is secretary and manager.

FESSENDEN, N. D.—Steps have been taken, it is reported, to organize a company to establish an electric-lighting system in Fessenden. J. Bursma, R. H. Smith and others are interested. The company will be capitalized at $15,000.

STANLEY, N. D.—Bids will be received at the office of W. C. Gibb, county auditor of Mountrail County, Stanley, N. D., until Aug. 3 for plumbing, electric work and heating and ventilating for the county court house. Plans and specifications may be seen at the above office or at the office of Buechner & Orth, architects, St. Paul, Minn.

ADAMS, NEB.—At an election to be held during this month the proposal to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters. Johnson & Johnson, of Falls City, are engineers.

BRUNSWICK, NEB.—Application has been made to the Village Council by Johnson & Anderson for a franchise to furnish electricity for lighting the village. They are planning to install an electric plant in connection with their garage and if granted a franchise will build a plant of sufficient output to supply electricity for street, commercial and domestic lighting.

GENOA, NEB.—The city of Genoa is installing a new series street-lighting system, consisting of 80-hp and 250-cp nitrogen tungsten lamps, a 10-kw Western Electric regulator and panel. O. B. Miller is superintendent.

LYONS, NEB.—Bonds to the amount of $15,000, it is reported, have been voted for the installation of a municipal electric-light plant in Lyons.

ARKANSAS CITY, KAN.—At an election held June 11 the proposal to issue $28,000 in bonds for a municipal electric-light plant was defeated. The proposal, it is said, will be again submitted to the voters in the near future.

ARMA, KAN.—At an election to be held July 14 the proposal to issue $8,000 in bonds for the installation of a municipal electric-light plant in Arma will be submitted to the voters.

GARDEN CITY, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 29 for construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Garden City, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Garden City. O. Wenderoth is supervising architect.

LEAVENWORTH, KAN.—The Brighton coal mine, situated near Leavenworth, has been taken over by W. J. Squires, of Kansas City, and others. It is understood that a power plant will be erected and the mine equipped with electrically driven machinery. The cost of the proposed improvement is estimated at about $500,000.

OLATHE, KAN.—The City Council has entered into a contract with the Olathe El. Lt. & Pwr. Co. for furnishing electricity for operating the pumping station for a period of four years.

SUMMERFIELD, KAN.—The contract for the construction of a local electric-lighting system and 18 miles of transmission line has been awarded to the Bushong Electrical Works, of Ottawa. D. L. Stromquist, consulting engineer, has charge of the work.

Southern States

CLINTON, N. C.—The power plant of the Sampson Pwr. Co., of Clinton, recently destroyed by fire, has been rebuilt and is nearly ready to put in operation. A 75-kw, three-phase, 2200-volt Crocker-Wheeler generator, with Westinghouse alternating-current switchboard, has been purchased. The old engine was repaired. G. E. Petty is secretary and manager.

HERTFORD, N. C.—The Council has engaged the J. B. McCrary Co., of Atlanta, Ga., to take charge of the construction of the proposed municipal electric-light plant, for which $12,000 in bonds was recently voted.

HOT SPRINGS, N. C.—The Industrial Pwr. Co., of Hot Springs, contemplates the development of a small water-power on the French Broad River, and will probably later develop a much larger one on the same river. The first development, located near Hot Springs, will consist of four or five units, probably vertical waterwheels directly connected to umbrella-type generators, two units being installed at first and the others later on. Water will operate under a 12-ft. head; each unit will have a rating of 400 or 500 hp. The company will probably acquire a larger water-power on French Broad River, an effective head of 85 ft. being available with approximately 2000 second-ft. of water available. Archibald Nichols is president and James E. Rector secretary, both of Asheville.

KINSTON, N. C.—Bonds to the amount of $100,000 have been voted for improvements to the municipal electric-light plant and for other municipal improvements.

LENOIR, N. C.—The property of the Citizens' Lt. & Pwr. Co., of Lenoir, has been taken over by Ashley & Co., of New York, N. Y. The company has recently established a day service. G. H. Aubrey, of Atlanta, Ga., is president, and E. C. Ivey, of Lenoir, secretary and treasurer.

SCOTLAND NECK, N. C.—Bids, it is reported, will be received at the office of the Mayor until July 23 for equipment for the municipal electric-light plant, including a 400-hp steam engine and a 250-kw, 2300-volt generator (engine type), with exciter and switchboard.

ORANGEBURG, S. C.—In a decision handed down by Judge Bowman the validity of the $60,000 bond issue for the erection of the water and light plant near the river by the city was upheld.

MILLEDGEVILLE, GA.—Plans are being considered by the Oconee River Mills, of Milledgeville, for the construction of a hydroelectric plant to be located on the site formerly occupied by the milling department.

QUITMAN, GA.—The city of Quitman is contemplating issuing bonds to the amount of $40,000, the proceeds to be used for improvements to the municipal electric-light plant. A. W. Voight is city clerk and treasurer.

JACKSONVILLE, FLA.—The Stribling Wave Pwr. Co., of Jacksonville, recently incorporated with a capital stock of $10,000, proposes to develop water-power and to manufacture motors for developing power from waves, etc. The officers are S. L. Stribling, president and general manager; Paul C. Marion, vice-president; A. N. Dobbins, secretary, and N. W. Marion, treasurer.

COOKEVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 30, for the construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office and court house at Cookeville. Drawings and specifications may be obtained at the above office or from the custodian of site at Cookeville. O. Wenderoth is supervising architect.

DYERSBURG, TENN.—Within the next six months the city of Dyersburg expects to erect 10,000 ft. of No. 8 and No. 10 insulated braided, weather-proof wire, and to purchase two single-pole, single-throw switches, to be used on 2300-volt circuits, 40 kva in pole transformers and one carload of poles. S. R. Blakeman is superintendent.

MARYVILLE, TENN.—The property of the Rockford El. Co., of Maryville, it is reported, has been purchased by W. E. Hunter, of Knoxville, representing an Eastern syndicate. The new owners have also applied for a charter for the Maryville Ice & Cold Storage Co., which proposes to erect an ice and cold storage plant, to be equipped with electrically operated machinery.

SPRINGFIELD, TENN.—The City Commissioners are considering issuing bonds to the amount of $10,000 for extensions and improvements to the municipal electric-light plant. G. B. Shawver is superintendent.

BAY MINETTE, ALA.—At an election to be held July 27 the proposal to issue $5,000 in bonds to install an electric-light plant will be submitted to the voters. Edgar B. Kay, of Tuscaloosa, is consulting engineer.

DADEVILLE, ALA.—The Alabama Pwr. Co., of Birmingham, it is reported, is contemplating a hydroelectric development at Cherokee Bluff on the Tallapoosa River. The proposed dam will be 150 ft. long and 300 ft. high. Electricity generated at the plant will be transmitted to Dadeville and other towns in Tallapoosa County.

GADSDEN, ALA.—The Alabama Pwr. Co. is contemplating extending its transmission lines from Gadsden to Huntsville, for which surveys have already been made. Negotiations are under way to supply electricity in Guntersville and other towns in the northern part of the State.

GURLEY, ALA.—It is reported that H. A. Smith, owner of the local electric-light plant (which was recently destroyed by fire) will rebuild plant. New equipment, including steam engine, boiler, generator and also an oil engine, will be installed.

JACKSON, MISS.—The question of purchasing the property of the Capital Lt. & Pwr. Co., of Jackson, to be owned and operated by the municipality is under consideration.

FORT SMITH, ARK.—The City Commissioners have authorized the city electrician and the city engineer to prepare the estimate of the cost of installing and maintaining a municipal electric-light plant.

MENA, ARK.—The Century Engineering & Construction Co., recently granted a franchise in Mena, will install an electric plant to furnish electricity here. George B. Thayer, of Mena, is president, and P. O. Benson, of Mena, is engineer in charge of work.

ALEXANDRIA, LA.—Plans are being considered by J. C. Raxsdale, superintendent of the municipal electric-light plant, for installing electric lamps on Third Street from Jackson Street to Lee Street, and probably from Jackson Street to Cason Street.

JONESBORO, LA.—The installation of an electric-light plant and water-works system in Jonesboro is under consideration. M. C. Jenkins, care of Tremont Mill, is reported to be interested in the project.

WINNSBORO, LA.—The installation of an electric-light plant in Winnsboro is under consideration. Carl Ship is reported interested in the project.

DAVIS, OKLA.—The Davis El. Lt. Co. soon expects to purchase a 30-kw generating set, consisting of engine and generator (three phase, 60 cycles, 2200 volts).

LAWTON, OKLA.—The Comanche Lt. & Pwr. Co., of Lawton, is preparing to discard its steam plant here and to install Busch-Sulzer Brothers Diesel engines and Westinghouse generators. A new brick power house will be erected and the entire distribution system will be rebuilt. John C. Keys is general manager.

MANGUM, OKLA.—The City Council has decided to submit the proposal to install a municipal electric-light plant in Mangum to the voters.

MARLOW, OKLA.—The city of Marlow expects to purchase within the next two months a 75-kva generator and a 100-hp gas engine. L. A. Prilchett is superintendent of the municipal electric-light plant.

PAULS VALLEY, OKLA.—The Washita El. Pwr. Co., of Pauls Valley, expects to purchase a 250-kw generator and engine within the next 60 days. The company also expects to erect an ice plant this fall. R. K. Johnston is secretary.

CLEBURNE, TEX.—Steps have been taken by the Cleburne Commercial Club for the installation of an ornamental street lighting system in the business district.

GAINESVILLE, TEX.—The Texas Pwr. & Lt. Co. has begun work on the erection of an electric light and power plant in Gainesville, to cost about $50,000. The company, it is stated, will also erect similar plants in Denison and two or three other places in North Texas.

HICO, TEX.—The Central Texas Pwr. & Transmission Co., of Hico, recently organized, has taken over the property of the Hico El. Lt. & Pwr. Co. The company is capitalized at $100,000 and proposes to do business in the counties of Erath, Hamilton, Bosque, Somerville, Comanche and Eastland. The power plant and main office are in Hico. H. Gleason is secretary and manager.

MAGNOLIA SPRINGS, TEX.—The Houston Ltg. & Pwr. Co. has applied to the City Council for a franchise to furnish electricty here. Magnolia Springs has not a post office.

MARBLE FALLS, TEX.—Application has been filed with the State Board of Water Engineers by R. E. Johnson, of Marble Falls, for water-power rights to operate an electric-light plant here.

MARBLE FALLS, TEX.—The Colorado River Pwr. Co., which is building a large hydroelectric plant on the Colorado River in Marble Falls, is preparing plans to construct a large dam and hydroelectric plant on the San Saba River. C. H. Alexander, of Dallas, is president of the company.

SAN ANTONIO, TEX.—Bids will be received by the San Antonio Water Supply Co., San Antonio, until Aug. 3 for two 5,000,000-gal. pumps and steam turbines, condensers and accessories, and three 250-hp boilers, etc. Specifications may be obtained on application to Robert Harding, chief engineer.

SAN BENITO, TEX.—The City Council has granted S. A. Robinson, trustee, a 50-year franchise to furnish water, lighting and telephone service in San Benito. The franchise will be transferred to a syndicate of English capitalists which will take over the plant of the San Benito Wtr. Co. It is proposed to install new machinery and make other improvements to the system.

TEXAS CITY, TEX.—The Board of County Commissioners has granted the Texas City El. Lt. & Wtr. Co. and the Texas City St. Ry. Co. franchises to extend their systems and furnish electrical and street railway service in the suburbs of Texas City, known as Texas City Heights and Subdivisions Nos. 5 and 6.

Pacific States

CASHMERE, WASH.—The Cashmere Wtr. Pwr. Co. has been granted a franchise to erect and maintain transmission lines on the highways in Chelan County, between Leavenworth and Wenatchee, for the distribution of electricity.

CENTRALIA, WASH.—The City Commissioners have authorized the city to enter into a contract with B. F. Walling, under which the latter agrees to furnish electricity for lamps and motors to the city at 1½ cents per kw-hr. Under the terms of the new contract Mr. Walling and associates agree to build a plant in Centralia and have it in operation by Feb. 1, 1915.

DAYTON, WASH.—The County Commissioners of Garfield County have granted the Pacific Pwr. & Lt. Co., of Portland, Ore., a franchise to erect and maintain electric transmission lines throughout the county of Garfield for a period of 50 years.

MONROE, WASH.—The property of the Monroe Wtr. & Lt. Co. has been taken over by the Monroe Wtr. Co., recently organized by Seattle capitalists. The new company has obtained a 35-year franchise and will furnish water and electricity in Monroe and to the farming district adjacent and to the State Reformatory. The company will install a new electrically driven pumping plant.

ASTORIA, ORE.—Arrangements are being made by the Northwestern El. Co., of Portland, Ore., for the construction of a large hydroelectric plant on the White Salmon River, 12 miles from Astoria. Orders for electrical equipment, it is understood, have not yet been placed. Through error this was published under Astoria, Wash., in the issue of July 4.

MEDFORD, ORE.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 22 for construction, including mechanical equipment (except elevator), lighting fixtures and approaches, of the United States post office and court house in Medford. Plans and specifications may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

WHEELER, ORE.—The town of Wheeler is installing an electric-lighting plant in connection with the water-works system.

PALO CEDRO, CAL.—The substation of the Northern California Pwr. Co. at Palo Cedro was recently destroyed by fire, causing a loss of about $3,000.

REDONDO BEACH, CAL.—The Board of Trustees has adopted the design submitted by the Lewellyn Iron Works for the ornamental lamp-posts to be erected in Redondo Beach. The plans provide for the installation of five-lamp clusters on Catalina Avenue from Pacific Avenue to Opal Street and on Pacific Avenue from Diamond Street to the intersection of Catalina and Esplanade; single lamps on Camino Real from the north city limits to Diamond Street and on the Esplanade from Pacific Avenue to Catalina Avenue, and three-lamp clusters on Diamond Street from Camino Real to Pacific Avenue.

SACRAMENTO, CAL.—The contract for equipment for the municipal sewage pumping plant No. 2 has been awarded to the Power Equipment Co., of San Francisco, at $38,400. Five pumping units will be installed and will include three motor-driven 350-hp and two 110-hp centrifugal pumps. General Electric motors and switchboard and Worthington pumps will be installed.

SAN FRANCISCO, CAL.—The Board of Public Works has granted the City El. Co. permission to erect poles on several streets in this city.

SALT LAKE CITY, UTAH.—A committee has been appointed by the State Street Improvement Association to make investigations in regard to the installation of an ornamental lighting system on State Street. Hyrum Pingree is president.

SALT LAKE CITY, UTAH.—Application has been made to the City Commission by the Dooly Building Pwr. Co., of Salt Lake City, for a franchise to furnish electricity and steam heat in Salt Lake City. The company was organized to furnish electricity and steam-heating service in the Dooly Building and several other buildings in the immediate vicinity of it. Several buildings have been erected recently by the Dooly estate in the vicinity of the original building, which necessitate enlarging the generating and heating plant. The application is to enable the company to supply service to other customers in the same district.

WILLARD, UTAH.—The Utah Lt. & Pwr. Co., of Salt Lake City, has installed a deep well on the farm of A. A. Lemon at North Willard for the purpose of determining the feasibility of irrigating land in the vicinity of Willard from deep wells by electrically operated pumps.

BAKER, MONT.—At an election held June 23 the proposal to grant a franchise to E. G. Heinrich to install and operate an electric-light system in Baker was carried. Arrangements are now being made by Mr. Heinrich to install the plant, which must be completed by Nov. 1.

MAXVILLE, MONT.—Work has commenced on the power project of the Royal Basin Mining Co. in Maxville, which will include the construction of dam and ditch ½ mile long to penstock and power house. About 2000 hp will be developed, which will be used at the works of the company and to light the village of Maxville.

ANTONITO, COL.—The City Council has accepted the proposal of Benjamin Desman, of Salida, to install and operate an electric-light plant in Antonito. The cost of the plant is estimated at $10,000.

GLENWOOD SPRINGS, COL.—We are informed that the bond issue of $110,000 recently authorized by the city was for the purchase of the water service of the Glenwood Lt. & Wtr. Co. The electric-light system is retained by the company, which will continue to operate as in the past. Reported in the issue of June 27 that the city of Glenwood had issued bonds to purchase the plant of the Glenwood company. H. G. Overbeck is general manager of the company.

LEADVILLE, COL.—The Western Development Co., which controls about 20 small companies in this district, has awarded contracts for hydroelectric equipment, costing about $100,000, to be installed in the Leadville plant.

NATURITA, COL.—Bids will be received by the Miguel Pwr. Co., it is reported, until July 18 for the construction of a power canal. The work includes 15,000 cu. yd. of excavation, 4000 cu. yd. of rock excavation, 350 cu. yd. of concrete and 53,000 ft. of lumber for flumes.

ALBUQUERQUE, N. M.—The Albuquerque Gas, El. Lt. & Pwr. Co. is contemplating the installation of a new street-lighting system to cost about $15,000.

TULAROSO, N. M.—An electric-light plant is being installed here by E. J. Peterson.

Canada

KELOWNA, B. C.—Contracts have been awarded by the city of Kelowna for equipment for the municipal electric-light plant as follows: For one 332-hp engine to Robert Hamilton & Co., Vancouver, agents for Goldie & McCulloch, Galt, Ont., at $3,810; condenser, $626, and 400-hp heater, $527; for 200-kw generator to the Canadian General Electric Co., at $2,635, and for switchboard panel to the Canadian Westinghouse Co., at $400. C. R. Yuill, of Vancouver, is consulting engineer.

VANCOUVER, B. C.—The City Council has passed a resolution requesting the district of North Vancouver to give the necessary year's notice to the British Columbia El. Ry. Co. of its intention to purchase the company's electric light and power franchise, which will be available in August, 1915.

WINNIPEG, MAN.—The Council of Fort Gary has authorized the municipality to enter into an agreement with the city of Winnipeg to furnish electricity in that city.

LUCAN, ONT.—The by-law authorizing an appropriation for the installation of a distribution system to utilize hydroelectric power in Lucan was passed at an election held recently.

OTTAWA, ONT.—The Ottawa & Hull Pwr. & Mfg. Co. is installing two additional units of 6000 hp each at its plant at Chaudière Falls, Ottawa, which will increase the generating capacity of the plant to 24,000 hp.

OWEN SOUND, ONT.—Plans are being considered for improving the street-lighting system to be used until hydroelectric power is available, when the system, it is said, will be entirely remodeled.

RENFREW, ONT.—Tenders are being asked by the Hydro-Electric Power Commission of Ontario for the installation of a new street-lighting system. The plans provide for about 65 cast-iron or concrete poles for ornamental lighting system and 150 lamps erected on brackets in the residential district. The ornamental lamps will be maintained by underground wires and the rest by overhead lines. Tungsten lamps will be used. The cost of the system is estimated at about $16,000. C. J. Murphy is chairman of lighting committee.

ST. CATHARINES, ONT.—Plans have been prepared for the installation of an ornamental lighting system (maintained by underground wires) for the Hydro-Electric Commission as follows: 105 lamp standards mounted with 1000-cp lamps on St. Paul, Queen and James Streets, to cost approximately $11,000; 61 single lamp standards carrying 100-watt lamps on Church and Ontario Streets, to cost about $6,093. J. S. Campbell is chairman of commission.

SIMCOE, ONT.—The by-law appropriating $40,000 for the purpose of installing a system to distribute hydroelectric power in Simcoe has been approved by the ratepayers.

Miscellaneous

GUANTANAMO, CUBA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 25 for furnishing and installing four 200-hp water-tube boilers with accessories in the central power plant, naval station, Guantánamo. Plans and specifications may be obtained on application to the above bureau. H. R. Stanford is chief of bureau.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until July 24 for furnishing copper tubing, galvanized wire, cable clips, etc. Blanks and general information relating to this circular (No. 860) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Aug. 7 for furnishing material for two 44,000-volt substations, including transformers, switches, lightning arresters, switch panels, annunciators, fittings, etc. Blanks and general information relating to this circular (No. 861) may be obtained at the above office. For details see proposal columns.

New Incorporations

LEEDS, ALA.—The Leeds Lt. & Pwr. Co. has been incorporated with a capital stock of $3,000. The officers are: Thomas W. Martin, president; W. R. Loyd, vice-president, and Wiley Alford, secretary and treasurer, all of Birmingham.

VENICE, CAL.—The Neptune Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by J. O. Kaiser, L. Buowski, F. Seeman and others.

NEWBURG, MO.—The Newburg Lt. & Pwr. Co. has been chartered with a capital stock of $4,000. The incorporators are J. O. Harpe, W. F. Houx and John Moore.

WESTBROOK, MO.—The Westbrook El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by K. Krueger, John E. Villa and others.

MILLERSBURG, OHIO.—The Citizens' Lt. & Pwr. Co. has been organized by G. H. Billman, R. E. Dryer, W. L. Koch, F. E. Kavanaugh and C. W. Tolad. The company is capitalized at $35,000 and proposes to construct and operate an electric light and power plant.

MOUNT CARMEL, PA.—The Mount Carmel Pub. Utilities & Public Ice Co. has been chartered with a capital stock of $300,000. The officers of the reorganized company are: J. M. Mitchell, president; Frederick W. Hurtenstein, vice-president, and Philip Barnhard, secretary and treasurer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 30, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,101,523. VAPOR ELECTRIC DEVICE; F. Conrad, Swissvale, Pa. App. filed Jan. 7, 1911. Electrode containing cup with inlet and inclined trough for conducting condensed vapors around inner side surface of cup.

1,101,527. ELECTRIC HEATING DEVICE; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Current automatically controlled by the object to be heated.

1,101,533. WIRELESS TELEGRAPHY; L. De Forest, New York, N. Y. App. filed June 20, 1906. Concentrates the signal waves in a definite general direction.

1,101,540. CONTACT-MAKING MECHANISM; C. I. Hall, Chicago, Ill. App. filed Dec. 30, 1912. Clock-driven.

1,101,550. ELECTRICALLY HEATED APPARATUS; T. Hoock, Bayenthal, Germany. App. filed Oct. 23, 1912. Cooking oven of the "heat-storage" type.

1,101,551. MELTING FERROMANGANESE; E. Humbert, Chicago, Ill. App. filed July 18, 1913. Maintains a covering layer of carbonaceous material upon the ferromanganese while molten.

1,101,554. ELECTRIC-RAILWAY SWITCH; D. W. Johnson, Saginaw West Side, Mich. App. filed March 1, 1913. Motor-operated, train-controlled.

1,101,555. WRAPPING AND UNWRAPPING MACHINE; C. Kuentzel, Akron, Ohio. App. filed May 12, 1913. For operating on cable tires, etc.

1,101,575. AUTOMATIC CURRENT CUT-OFF FOR ELECTRIC APPLIANCES; U. S. Smith, Sacramento, Cal. App. filed July 31, 1913. Prevents overheating of electric irons, etc.

1,101,579. FLEXIBLE ELECTRIC CONDUCTOR; L. Steinberger, New York, N. Y. App. filed July 3, 1911. Trolley wire consisting of copper sheathing over steel supporting wire.

1,101,618. MOTOR GENERATOR; C. W. Drake, Chicago, Ill. App. filed Oct. 11, 1911. Steam turbine separated from generator by a connecting sleeve containing the shaft bearings.

1,101,620. EXTRACTION OF A METAL BY ELECTROLYTIC EXHAUSTION OF A SOLUTION OF A SALT OF THIS METAL; N. H. M. Dekker, Paris, France. App. filed May 14, 1913. Anode dips in water separated from the cathodic bath by a porous wall.

1,101,629. ARC CONTROL MECHANISM FOR PROJECTORS; J. L. Hall, Schenectady, N. Y. App. filed March 20, 1908. Maintains arc of constant length by automatically increasing as well as diminishing the gap between the electrodes.

1,101,648. IGNITION APPARATUS; H. Lyon, Gloucester City, N. J. App. filed March 27, 1911. Hot-wire igniter for gas lamps.

1,101,665. VAPOR-ELECTRIC DEVICE; Y. Sakai, East Pittsburgh, Pa. App. filed Jan. 7, 1911. Barriers interrupt the flow of condensed vapor to prevent same from completing circuit between outside and inside of cup.

1,101,666. TROLLEY POLE AND TROLLEY GUARD; T. Santore, Mount Braddock, Pa. App. filed July 3, 1912. Guard jaws opened and closed by lowering and raising of trolley pole.

1,101,669. CONTROLLER; L. L. Tatum, Milwaukee, Wis. App. filed Sept. 20, 1911. Compels attendance of operator until desired conditions obtain, as in centrifugal hydro-extractors.

1,101,670. RELAY; A. A. Tirrill, Schenectady, N. Y. App. filed April 27, 1908. For opening and closing any number of shunt circuits.

1,101,672. INDUCTION-MOTOR WINDING; J. E. Webster, Pittsburgh, Pa. App. filed July 6, 1908. Dovetail connection between conductor bars and end-ring segments of rotor.

1,101,679. SELECTIVE SIGNALING DEVICE; J. P. C. Boswau, New York, N. Y. App. filed April 1, 1913. Step-by-step circuit-closing device.

1,101,684. AUTOMATIC TELEPHONE-EXCHANGE SELECTOR; E. B. Craft, Hackensack, N. J. App. filed Feb. 26, 1912. For serving relatively large number of lines.

1,101,728. LIGHTNING ARRESTER; E. V. Craft, Hackensack, N. J., App. filed March 1, 1913. Vacuum type.

1,101,731. SWITCHBOARD PLUG; R. M. De Vignier, Hollis Terrace, N. Y. App. filed March 1, 1912. Multiple-conductor twin plug.

1,101,742. INCUBATOR; E. C. Hays, Waco, Tex. App. filed Jan. 28, 1914. Thermostatic control of electric heaters.

1,101,752. LIGHTNING ARRESTER; D. T. May, New York, N. Y. App. filed March 1, 1913. Vacuum type, for retaining arc at a definite point on the electrodes.

1,101,798. CONTACT-MAKING VOLTMETER; C. J. Hejda, Chicago, Ill. App. filed Oct. 11, 1910. For maintaining voltage constant.

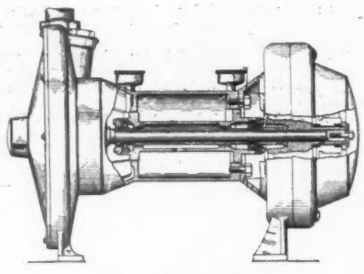
1,101,802. CONDUCTOR CLAMP; M. G. Kennedy, Syracuse, N. Y. App. filed Aug. 22, 1910. For securing vertical conductor to glass insulators.

1,101,814. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES; A. N. Sammarone, Akron, Ohio. App. filed Oct. 31, 1913. Made from single piece of stamped and folded metal.

1,101,821. ELECTRIC HEATING DEVICE; T. Van Aller, Schenectady, N. Y. App. filed June 7, 1912. Heat of iron or other device governed according to the demand.

1,101,830. SUBMARINE SIGNAL-RECEIVING APPARATUS; C. Berger, New York, N. Y. App. filed Nov. 4, 1912. Supported in the open water immediately adjoining the ship's hull.

1,101,838. SLEET CUTTER FOR OVERHEAD TROLLEYS; J. E. Dozier, Lynn, Mass. App. filed Jan. 5, 1911. Special cutter insulated from trolley.



1,101,618—Motor-Generator

1,101,853. AUTOMATIC TELEPHONE SYSTEM; A. E. Keith and J. and C. J. Erickson, Chicago, Ill. App. filed Sept. 18, 1905. Calling-dial construction.

1,101,854. AUTOMATIC TRUNKING SYSTEM; A. E. Keith, Hinsdale, Ill. App. filed March 1, 1910. Embodies primary and secondary non-numerical trunking switches. (Fifty-four claims.)

1,101,858. PROCESS OF JOINING METAL; L. S. Lachman, New York, N. Y. App. filed June 16, 1910. Welds the rounded head of one member to the surface of the other member.

1,101,866 CIRCUIT-CLOSER; D. A. McVonneil, Arlington, N. J. App. filed Aug. 17, 1910. Push-button for electric horns.

1,101,870. LOCK SWITCH; E. R. McKinzie, Memphis, Tenn. App. filed Dec. 8, 1913. Switch member turned by an inserted key.

1,101,892. PIPE-CONDUIT FITTING FOR ELECTRIC INSTALLATION; W. H. Vibber, New London, Conn. App. filed Sept. 26, 1913. Has a longitudinally divided two-part box.

1,101,897. REFILLABLE-CARTRIDGE FUSE; E. Alexander, Burlingame, Cal. App. filed Sept. 11, 1913. Eccentrically pivoted disks close the ends of the fuse casing.

1,101,914. APPARATUS FOR ELECTRIC SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed March 31, 1908. Receiving station having a radiating conductor in close proximity to the earth.

1,101,915. WIRELESS SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed March 8, 1909. Antenna having a large capacity, arranged horizontally and elevated but a short distance above the earth.

1,101,917. BRUSH-HOLDER; D. B. Flower, Glenside, Pa. App. filed Jan. 29, 1910. For street-railway motors; has tension-adjusting and tension-indicating means.

1,101,938. VOLTAGE REGULATOR; W. G. Kinton, Chicago, Ill. App. filed June 24, 1908. For telephone bell-ringing generator.

1,101,939. WIRE CONNECTOR; G. C. Knauff, Chicago, Ill. App. filed Feb. 17, 1913. Plug and socket for lighting systems of automobiles.

1,101,946. INDICATING ELECTRIC FUSE PLUG; J. H. Miller, Bridgeport, Conn. App. filed April 4, 1912. Fuse releases spring which throws out a protruding indicating point.

1,101,956. IGNITION DEVICE FOR EXPLOSIVE ENGINES; E. Podlesak, Tiffin, Ohio. App. filed Nov. 29, 1912. Make-and-break type.

1,101,958. SAFETY CIRCUIT CONTROLLER FOR TRAFFIC-CONTROLLING SYSTEMS; W. H. Reichard, Troy, N. Y. App. filed Dec. 13, 1911. For switches and signals.

1,101,963. DEVICE FOR SECURING CONDUCTORS TO JUNCTION BOXES; M. C. Rosenfeld, Cleveland, Ohio. App. filed Nov. 16, 1911. Cam nut clamps contractible part of the junction box sleeve upon the cable.

1,101,987. SIGNALING SYSTEM AND APPARATUS; C. E. Beach, Binghamton, N. Y. App. filed June 11, 1913. Fire-alarm box.

1,101,994. CENTRIFUGALLY OPERATED SWITCH; A. J. Brown, Milwaukee, Wis. App. filed Nov. 13, 1908. For short-circuiting the resistance as the motor approaches full speed.

1,101,997. ELECTROMAGNETIC BRAKE; N. E. Church, Pittsfield, Mass. App. filed March 20, 1913. Non-frictional means for reducing speed of a rotating shaft, etc.

1,101,999. BURGLAR ALARM; W. E. Clark, Saranac Lake, N. Y. App. filed Aug. 16, 1912. For preventing safe-breaking in post offices, stores, etc.

1,102,000. VACUUM-CLEANER HANDLE; G. Clements, Chicago, Ill. App. filed Nov. 12, 1913. With inclosed switch and operating member projecting therefrom.

1,102,007. SOUND TRANSMITTER; W. H. Cotton, Chicago, Ill. App. filed Nov. 14, 1911. For concentrating sound waves in a telephone mouthpiece.

1,102,009. ELECTRIC LAMP; H. Csanyi, New York, N. Y. App. filed May 14, 1913. Circuit automatically interrupted when bulb is broken for mines.

1,102,010. PRIMARY BATTERY; H. Csanyi, New York, N. Y. App. filed July 3, 1913. Has gas-venting means operable in any inclined position.

1,102,079. SEPARABLE FIXTURE JOINT; A. D. Rizer, Elgin, Ill. App. filed Jan. 21, 1913. For preventing twisting of the conductor wires.

1,102,116. DYNAMO-ELECTRIC MACHINE; J. J. Wood, Fort Wayne, Ind. App. filed April 26, 1913. Synchronous motor coupled to electric motor through resilient means.

1,102,119. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINERY; A. Aichele, Baden, Switzerland. App. filed May 4, 1912. Brush can move at right angles along commutator surface.

1,102,126. WIRE CONNECTOR; E. C. Barnes, E. T. Hagist and G. Neil, Philadelphia, Pa. App. filed Dec. 3, 1913. For clamping one cable at right angles to another.

1,102,164. SWITCHBOARD-CORD REEL; F. R. Parker, Chicago, Ill. App. filed May 27, 1907. For telephone cords; springs wind the reels.

1,102,184. DETECTOR FOR WIRELESS TELEGRAPHY; R. C. Browne, Salem, Mass. App. filed Aug. 15, 1907. Terminal containing oxide of zinc and opposing terminal consisting of an ore containing copper.

1,102,194. LIGHTING SYSTEM; E. B. Jacobson, Pittsfield, Mass. App. filed May 2, 1912. For automobiles.

1,102,209. ELECTROLYTIC PROCESS OF AND APPARATUS FOR PRODUCING COMPOUNDS; E. A. Byrnes (deceased), Washington, D. C. App. filed July 25, 1903. For electrolysis of alkali-metal salts.